FEASIBILITY STUDY REPORT
CEDAR CHEMICAL CORPORATION
HELENA-WEST HELENA, ARKANSAS

Submitted to:

ExxonMobil Corporation and Helena Chemical Company

Submitted by:

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The report entitled "Feasibility Study Report" dated August 2009 was prepared on behalf of ExxonMobil Chemical Company and Helena Chemical Company. The report was prepared under the supervision of the undersigned Arkansas Register Professional Geologist.

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TABLE OF CONTENTS

TABLES

FIGURES

TABLE OF CONTENTS

FIGURES
(Continued)

APPENDICES

FEASIBILITY STUDY
FORMER CEDAR CHEMICAL CORPORATION FACILITY
Helena-West Helena, Arkansas

1.0 INTRODUCTION

This Feasibility Study (FS) presents the objectives and approach for remedies recommended to address the presence of elevated Constituents of Concern (COCs) at the former Cedar Chemical Corporation Facility ("the Facility"). The Facility is located in the Helena-West Helena Industrial Park approximately 1.25 miles southwest of the intersection of U.S. Highway 49 and State Highway 242, in Phillips County, Arkansas (Figure 1). The recommended remedies were selected based on the results of previous investigations and a risk screening of COCs in soil and groundwater.

On March 22, 2007, the Arkansas Department of Environmental Quality (ADEQ) issued a Consent Administrative Order (CAO) regarding environmental conditions at the Facility to Ansul, Inc., formerly known as Wormald US, Inc., Helena Chemical Company, and ExxonMobil Chemical Company, a division of Exxon Mobil Corporation, pursuant to the authority of the Arkansas Remedial Action Trust Fund Act ("RATFA"). The stated objective of the CAO is to "address environmental concerns at the Facility to ensure protection of human health and the environment." The CAO requires these companies to perform various tasks with respect to environmental conditions at the Facility.

Pursuant to Paragraph V. 20 of the CAO, Helena and ExxonMobil (hereafter the Group), acting jointly, entered into a Separate Agreement with ADEQ on March 25, 2008. Although Ansul, Inc. signed the CAO, it is not a party to the Separate Agreement and it has not contributed to any work described in this report. This Separate Agreement stipulated that a site investigation and FS process would be accomplished through the completion of the following:

- Preparation and submittal of a Current Conditions Report (CCR), compiling available information and data for the Facility, to ADEQ. This CCR was submitted on November 16, 2007.

- Preparation and submittal of a Facility Investigation (FI) Work Plan to ADEQ. This work plan was submitted on January 18, 2008, re-submitted on March 20, 2008 with revisions based on ADEQ comments, and conditionally approved by ADEQ on March 25, 2008. A supplement to the FI Work plan, describing additional well installations, was submitted to ADEQ on August 28, 2008, and approved by ADEQ on September 5, 2008.

- Performance of the FI activities described in the FI Work plan. The planned field work was completed in August 2008.

- Preparation and submittal of a Preliminary FI Report. This report was submitted to ADEQ on October 13, 2008.

- Preparation and submittal of the FI Report. This report was submitted to ADEQ on February 24, 2009, and replacement pages addressing the ADEQ comments were submitted to ADEQ on May 29, 2009. ADEQ approved the revised FI Report in a letter dated June 4, 2009.

- Preparation and submittal of an FS based on FI findings. This document was prepared and is being submitted on behalf of the Group to satisfy this requirement.

2.0 BACKGROUND INFORMATION

The Facility was constructed in 1970 and operated until 2002. There have been no production operations at the Facility since 2002. When the Facility was active, operations consisted primarily of the manufacture and blending of pesticides, herbicides, and specialty chemicals.

The Facility is located to the south of the city of Helena-West Helena, in Phillips County, Arkansas, and consists of 48 acres within the Helena-West Helena Industrial Park approximately 1.25 miles southwest of the intersection of U.S. Highway 49 and State Highway 242. Figure 1 illustrates the location of the Facility. The Facility is bordered by farmland, State Highway 242, a rail spur, and Industrial Park properties.

The former operational portion of the property is divided into two major areas:

- Approximately 40 acres comprising the abandoned manufacturing area, on the north side of Industrial Park Road, and

- Approximately 8 acres comprising the current wastewater treatment system area, on the south side of Industrial Park Road.

An undeveloped, wooded area west of the wastewater treatment ponds and south of Industrial Park Road is also part of the site property, but does not appear to have historically been part of the manufacturing facility. Figure 2 illustrates the locations of process units and other salient site features.

The Site is underlain by several units of unconsolidated Quaternary and Tertiary age sedimentary deposits. There are two shallow groundwater units at the site:

- The Perched Zone, present within low-permeability silt and clay surficial sediments (ground surface to approximately 30-40 feet below ground surface [bgs]) and

- The Alluvial Aquifer, extending from approximately 40 to 150 feet bgs.

The Alluvial Aquifer is, in turn, underlain by the Jackson-Claiborne Group (which includes the Jackson Clay), which is approximately 250 feet thick in the site area. The Jackson-Claiborne Group is a thick, low permeability stratum comprised of clay and lignite that acts as a regional confining unit beneath the Alluvial Aquifer.

3.0 SUMMARY OF FACILITY INVESTIGATION FINDINGS

There was extensive investigative work performed at the Facility prior to the FI. This included, but is not limited to, a 1988 hydrogeologic assessment by Grubbs, Garner & Hoskyn, multiple episodes of soil and groundwater assessment by EnSafe in 1993 to 1995, a risk assessment by EnSafe in 2001 and 2002, and a 2005 groundwater monitoring event performed jointly by ADEQ and the U.S. Environmental Protection Agency (USEPA) Region 6. More detailed discussions of the scope and findings of this previous work are provided in the CCR submitted to ADEQ in November 2007. The CCR also includes information regarding the Facility's setting, past environmental conditions, historical ownership, and surroundings.

The FI was conducted to supplement the previous investigative work, by addressing gaps in the existing assessment data, updating the understanding of groundwater conditions, and developing information needed to support remedy selection. FI investigation work, including soil borings, cone-penetrometer studies, new monitoring well installation, soil and groundwater sampling, and aquifer testing, was performed predominantly between March and November 2008. The results were submitted to the ADEQ in the FI Report and FI Supplemental Information dated February and June 2009, respectively.

The FI findings were used to identify Constituents of Concern (COCs) in on-site soil and in on-site and off-site groundwater; the primary COCs were volatile and semivolatile organic constituents, metals, pesticides and herbicides. In addition, the FI further delineated the distribution and magnitude of predominant COCs in soil and groundwater; these data were used to identify likely source areas for these COCs.

The primary conclusions of the FI were:

- On-site soils in the former Process Areas are impacted by volatile organic constituents (VOCs), semivolatile organic constituents (SVOCs), pesticides and herbicides, and possibly low levels of certain metals.

- Advective groundwater flow within the shallower Perched Zone and related lateral transport of COCs in this zone's groundwater is limited by the low hydraulic conductivity of this zone.

- The deeper Alluvial Aquifer is highly transmissive, with groundwater flowing generally from the Facility toward the Industrial Park and agricultural properties to the south and southeast.

- Certain COCs are migrating vertically through leakage from the Perched Zone to the Alluvial Aquifer. Based on the contrast in COC concentrations between these two zones, most of the contaminant mass is likely being retained in the low permeability soils of the perched zone.

- The primary groundwater constituents observed above screening levels in Perched Zone groundwater were 1,2-dichloroethane (1,2-DCA), 1,2-dichlorobenzene (1,2-DCB), dinoseb, 4-chloroaniline, toluene, and acetone.

- In the Alluvial Aquifer, the primary groundwater constituents observed above screening levels were 1,2-DCA, 1,2 DCB, bis(2-chloroethyl) ether, and 4-chloroaniline.

- With the exception of on-site or nearby off-site areas within the Industrial Park, the primary Alluvial Aquifer groundwater COC that exceeds its screening level was 1,2-DCA. 1,2-DCA has been documented to be present at least 2,700 feet downgradient of the Facility boundary, beyond the southern end of the Industrial Park. Updated delineation of the boundary of 1,2-DCA beyond the Industrial Park was not undertaken during the FI because of litigation filed by the subject property owner.

- The most significant source areas for Perched Zone and Alluvial Aquifer COCs are Process Areas and waste disposal areas, especially the vicinity of the Former Dinoseb Disposal Ponds.

- The Drum Vault contains highly dilapidated drums of unknown products or wastes; the vault also contains sand backfill and water. The backfill and water exhibit elevated levels of various VOCs, SVOCs, pesticides, and herbicides.

- Agricultural supply wells have been identified downgradient of the property. No downgradient water supply wells have been identified near the Facility that would be used for drinking water or domestic supply.

Many of the compounds that have historically been detected in Alluvial Aquifer groundwater were not detected during the FI. Those compounds that were detected were generally present at concentrations well below historic maxima. Based on these trends, both the mass and concentrations of COCs present in the Alluvial Aquifer have declined since operations ceased at the Facility.

4.0 REMEDY OBJECTIVES

Remedy objectives were established based on the results of the FI and risk-screening evaluation, taking into consideration key COCs and their migration and exposure pathways, potential receptor points and anticipated future site use. The remedy objectives establish the expectations for the remedy's direction and performance, and provide metrics for its short-term and long-term effectiveness.

The remedy objectives identified for the Facility are as follows:

- Protect the health of the public, site workers, and others that may be present at the Facility or in its environs, given its expected mode of future use, by controlling current and future exposures to soils and groundwater that contain COCs at concentrations above risk screening criteria.

- Accelerate the natural attenuation processes in the Alluvial Aquifer by reducing on-site sources of COCs in both shallow soils and the Perched Zone, thereby reducing both the size and duration of the Alluvial Aquifer plume.

- Enhance the future usability of the site by establishing controls that are compatible with a range of commercial or industrial uses, within reasonable limitations, and that avoid activities or uses that would compromise public safety or the effectiveness of on-going remedy controls.

- Leave the Facility property in a condition such that storm water runoff is suitable for discharge either with minimal or no treatment. This will require that contact between storm water and contaminated media be reduced.

The engineering and institutional controls recommended for use as remedies in Section 6.0 of this FS were selected to meet these objectives.

These objectives consider the reasonable anticipated future land use for the Facility. This land use is anticipated to be commercial or industrial in character. As discussed in Section 6.0, many of the remedy elements will require future users to avoid activities that will disturb or expose in-place soils or groundwater, or that remove or disrupt the engineering controls implemented at the Facility. Given this, examples of industrial use that could be compatible with the anticipated future condition of the Facility could include:

- Truck terminal

- Cargo storage or transshipment

- Vehicle storage or parking
- Propane or LP Gas storage and distribution
- Warehousing

Many forms of commercial usage would be possible, as long as buildings and other improvements to support that use could be constructed in a manner that was compatible with engineering and institutional controls discussed in Section 6.0.

5.0 HUMAN HEALTH RISK SCREENING ANALYSIS

A risk-based screening analysis of site soils and groundwater was prepared by the Center for Toxicology and Environmental Health (CTEH) and is included in Appendix A. This analysis performed a comparison of COCs in on-site soils and on and off-site groundwater to USEPA 2007 generic screening values. It also included an exposure assessment to evaluate potential pathways of human exposure to COCs, and to calculate risk-based concentrations for potential receptors. The potential exposure pathways identified for each Facility media are:

- On-Site Soils
  - ◊ Total exposure (combined contact, ingestion, and inhalation pathways)
  - ◊ Vapor Intrusion
- Perched Zone Groundwater
  - ◊ Total exposure (combined contact, ingestion, and inhalation pathways)
  - ◊ Vapor Intrusion
- Alluvial Aquifer Groundwater
  - ◊ Ingestion
  - ◊ Irrigation Use

With respect to groundwater ingestion, the analysis performed by CTEH identified exceedances of either a federal Maximum Contaminant Level (MCL) or a 2007 EPA Tap-Water Medium Specific Screening Level (Tap Water MSSL). For the purposes of risk screening, the use of both criteria represents a conservative approach. For purposes of remedy selection, however, both the MCL and the Tap Water MSSL are, by definition, considered adequately protective of human health. For the purposes of this FS, then, exceedances of the higher of the MCL and Tap Water MSSL (for those COCs which have both) were used to select remedies.

With respect to the irrigation use pathway at this site, potential exposures have been previously evaluated by the Arkansas Department of Health and Human Services (ADOH), under the auspices of the Agency for Toxic Substances and Disease Registry; their findings were documented in two reports dated August 1, 2005 and June 16, 2006. ADOH concluded that the use of irrigation water from wells with 1,2-DCA concentrations ranging to 27,100 ug/l "poses no apparent public health hazard to exposed individuals." In addition, the 2006 report noted that modeled results for residential exposure for children were also below health risk values. Given this, the irrigation pathway is not anticipated to represent a potential public risk, and is not utilized in remedy selection.

Information regarding the COCs for each media that exceeded applicable risk screening criteria is summarized in Tables 1 through 4. The distribution of exceeding COCs are illustrated in Figures 3 (on-site soils), 4 (Perched Zone groundwater), and 5 (Alluvial Aquifer groundwater).

6.0 SOIL AND GROUNDWATER REMEDY RECOMMENDATIONS

AMEC has identified a suite of remedies that are protective of human health and the environment, and would meet the remedy objectives discussed in Section 4.0 of this FS. These remedies would also meet applicable regulatory criteria, including the USEPA guidelines for corrective action and the most recent USEPA OSWER Directive 9283.1-33 dated June 26, 2009. They have been selected for recommendation based on information sufficient to support risk management decisions, including the remedy objectives for the site, the results of the risk-based screening analysis discussed in Section 5.0, the current and expected future uses for the property, and current surface and subsurface conditions.

In accordance with applicable government policy, cost was not a primary determinant in remedy selection, but cost effectiveness was considered in the selection. Specifically, remedy alternatives were first required to meet all remedy objectives, regardless of cost. Cost effectiveness was then used as one method of selecting a recommended remedy from among those available, as well as ruling out remedies that would not achieve objectives in a reasonably cost effective manner.

The combination of recommended remedies consists of a combination of:

- Engineering controls—including source stabilization and removal, groundwater monitoring, ground covers, and vapor controls.
- Institutional controls—including ordinance-based or deed restrictions and other legal limitations on types of land use or other actions that could create unsafe exposure scenarios or reduce the effectiveness of the engineering controls.

The specific remedy elements for specific media and site features are discussed in the following sections.

6.1 ON-SITE SOILS

Based on soil samples collected both during the FI and during previous investigations, and as discussed in Section 5.0, Figure 3 presents COCs in on-site soil that are present at concentrations exceeding risk-based screening criteria.

Most of the soil COC concentration exceedances are present in the Process Areas of the Facility, although there are a few exceedances in other areas. Within the Process Areas, these exceedances are generally scattered, which is consistent with the original characterization of the area as likely having experienced releases from a number of different sources and source areas. There is, however, a significant locus of exceedances in the vicinity of the Former Dinoseb Disposal Ponds, near the Pump Shop. In addition, Perched

Zone groundwater exhibits the highest observed concentrations of 1,2-DCA beneath the former Dichloroaniline Unit (Unit 6) (Figure 6), which indicates the likely presence of elevated 1,2-DCA in soils beneath this unit.

The following remedy elements are recommended to address COCs in on-site soils:

Source Control

As discussed in more detail in the FI, on-site soils are likely an ongoing source of impact to Perched Zone groundwater. Groundwater from the Perched Zone appears to be, in turn, leaking downward to the Alluvial Aquifer, adversely impacting groundwater quality in that zone. Stabilization or removal of source soils in these areas should, therefore, contribute to improvements in groundwater quality in the Perched Zone and Alluvial Aquifer, and enhance the effectiveness of groundwater remedies discussed in later sections.

In order to reduce the role of on-site soils as a source of groundwater impact, the recommended remedy will consist of:

- The stabilization of soils in the vicinity of the Former Dinoseb Disposal Pond area, using *in situ* soil mixing, in order to reduce the leachability and mobility of COCs in this source area. This method will be used to address soils within a geographically defined area (see Figure 7), and will extend to just below the top of the Perched Zone saturated interval (an estimated typical depth of 20 feet). Augers or other mechanical equipment will be used to mix soils in the defined area with a stabilizing material such as Portland Cement or flyash. The mixing method and stabilant, as well as any necessary controls during the mixing process, will be selected and described during the Remedial Design phase of this project (see Section 10.0).

- Reduction of the mass of VOCs within soils beneath Unit 6 using soil vapor extraction (SVE). Based on the shallow depth to water and high clay content of soils at this location, the SVE strategy will be to utilize a close extraction well spacing and relatively low vacuum pressures. For the purposes of this FS, a well spacing of approximately 20 feet and vacuums of approximately 40 inches of water are assumed. A schematic of the anticipated system configuration is shown on Figure 8. The extraction wells will be manifolded to the suction side of an extraction/treatment unit. Water condensing from the extracted vapor will be routed via a moisture knockout system to an aboveground tank. This water will be periodically collected for discharge to the Publicly Owned Treatment Works (POTW) intake at the Facility, subject to approval by the POTW operator. Depending on the quality of air emissions and the mass of VOCs to be emitted, the system will include treatment and permitting to comply with applicable regulations. Treatment options would include, but not be limited to carbon adsorption or thermal oxidation/acid scrubbing. Notwithstanding the system descriptions provided in this bullet, the actual system specifications and operating parameters will be developed as a part of Remedial Design. This will include any pilot testing and other activities needed to develop a final system design, as well as operating protocols.

The following alternative remedies were considered for Source Control, but were not selected:

- No further action – This scenario would reduce remedy costs, but could potentially allow on-going contribution of COCs from soils to groundwater, reducing the effectiveness of groundwater remedies. This was considered an undesirable remedy outcome that was inconsistent with remedy objectives.

- Excavation and off-site disposal of soils from the area of the Former Dinoseb Disposal Ponds – It can be difficult to rigorously characterize in place soils for disposal prior to excavation, especially given the heterogeneous nature of soil impact at this Facility. There will always be some potential to encounter a body of soils containing higher-than-expected COC levels during the excavation process. If such a body of soils were to be encountered and required management and disposal as hazardous waste, then, this could result in sudden and substantial changes to the cost and logistics of this approach. Soil stabilization was considered to provide a more predictable outcome, and was therefore selected over excavation and off-site disposal.

- Excavation and off-site disposal or stabilization of soils at locations other than the Former Dinoseb Disposal Ponds or Unit 6 – Although there are a number of areas at the Facility where soil COCs exceeded screening levels (Figure 3), these are distributed in a scattered pattern across the Facility process areas. These areas are different in this aspect from the more localized areas of COCs present in the area of the Former Dinoseb Disposal Ponds and Unit 6 discussed above. Because of their non-localized distribution, these areas are more of a challenge for active control strategies such as excavation or stabilization. In addition, the potential unknowns regarding waste characterization discussed in the preceding bullet would also apply here. Given these considerations, the management of these areas through exposure controls was believed to be a more effective approach.

- SVE at locations other than the Former Dinoseb Disposal Ponds or Unit 6 – The COCs that exceed risk thresholds in these soils are typically pesticides or herbicides with low volatility, so SVE would not be an appropriate remedy.

Exposure Control

As noted above, there are scattered areas across the Facility property where surface or shallow subsurface soils contain COCs at concentrations above risk screening criteria. Future exposure scenarios at these locations would include site workers and visitors, as well as workers performing any activities that might disturb these soils (e.g., drilling, foundation or utility excavation). The following remedies are recommended to control future exposures to these soils:

- The construction of a soil cover in the Process Area. Following demolition of the above ground portions of site buildings and process units, and the plugging of storm drains and other underground structures in this area, the Process Area will be covered with a surface of asphalt pavement, including any needed base material. This pavement will be constructed in a manner that is suitable for normal commercial and industrial vehicle traffic, including semi-tractor trucks. This pavement will be continuous with foundations and other concrete structures left in place post-demolition. In addition, any significant breaches in the integrity of existing foundations, pads, or other concrete structures within the cover footprint will be repaired as a part of cover construction. The pavement and existing at-grade concrete structures together will comprise the soil cover in the Process Area. The anticipated footprint of this cover is shown on Figure 7.

  In addition, the storm water collection ditch area on the southeast portion of the process areas (Figure 7) will be lined with geotextile overlain with approximately one foot of clean, low permeability soils. This geotextile/soil layer will then be graded to maintain drainage to the south, and revegetated. Until revegetation is complete, the area will be monitored for excessive erosion, and repaired as needed. This geotextile/soil layer will also function as part of the overall soil cover.

  The primary purpose of the soil cover is to reduce the potential for direct exposure to soils by workers and other potential receptors. In addition, it should provide corollary benefits of improving storm water runoff quality, and reducing the infiltration of storm water through shallow soils. The reduction of infiltration will reduce this flux of soil COCs to the Perched Zone and Alluvial

Aquifer, enhancing the effectiveness of the groundwater remedies discussed below.

- Institutional controls, including deed notices, ordinances, restrictive covenants, and other applicable measures. Notices would be used to provide information to potential future buyers of the Facility property of the presence and location of soil COCs. Controls would limit the use of the Facility property to commercial/industrial activities, and prohibit certain non-industrial commercial uses (e.g., health care or children's day care) that would create an unacceptable risk scenario. Site control and security measures, such as fencing, would be required to limit public access to the Facility property. These institutional controls would also limit activities that could disturb either the soils or the cover described above. Any disturbance of the soil cover would require prompt and complete repair. Any activity that would involve soil disturbance would require a work area-specific characterization of COCs, and utilization of personnel, equipment, and methods appropriate for work with soils containing chemical contaminants. Soils generated from any such activities would be managed in a manner that complied with state and federal regulations.

The following alternative remedy was considered for Exposure Control, but was not selected:

- No further action – This scenario would reduce remedy costs, but could potentially allow uncontrolled exposures to soil COCs at levels above risk thresholds. This was considered an unacceptable remedy outcome that was inconsistent with remedy objectives.

6.2 PERCHED ZONE GROUNDWATER

The hydrogeologic characteristics of the Perched Zone are explained in detail in Section 4.0 of the FI Report. In general, this zone is a low yield, unconfined, laterally extending unit typically comprised of silty, high plasticity clays extending from ground surface to approximately 30-40 feet bgs.

Based on the extremely low hydraulic conductivities and corresponding low well yields observed in the Perched Zone, it is not realistic that this unit could be used locally for groundwater supply. Given this, the remedies selected to meet remedy objectives for Perched Zone groundwater were specifically intended to address exposures to Perched Zone COCs related either to the generation of vapors from that zone, or through activities that could disturb Perched Zone groundwater. These recommended remedies are:

- Monitored Natural Attenuation – Future monitoring will be needed to confirm whether attenuation processes are active in the Perched Zone. However, since Facility operations ceased, the declines in the number and magnitude of most COCs in the Alluvial Aquifer suggest that similar declines are occurring in Perched Zone groundwater as well.

  Water quality in the Perched Zone will therefore be monitored on a regular basis. The monitoring frequency will be developed as a part of Remedial Design (Section 10.0), but is currently anticipated to be semiannually at first, transitioning to annual and then biannual if data trends remain stable. The monitoring network will utilize selected existing wells (including wells installed as a part of the FI). These wells will be selected both to represent suspected source areas such as Unit 6, and the perimeter of the Perched Zone area of impact. Analytes will consist of a target list of those COCs that exceed risk screening criteria. Monitoring data will be periodically evaluated to confirm that attenuation is occurring, with evidence of such attenuation including any or all of the following:

    - A reduction in the area or footprint within which COCs exceed risk screening criteria.

    - A reduction in the number of COCs present that exceed risk screening criteria.

    - A reduction in the maximum or overall concentrations of COCs.

  Monitoring data and their evaluation will be reported annually or biannually (depending on monitoring frequency) to ADEQ. If data trends over a sustained period do not support the conclusion that attenuation is occurring, then a future re-evaluation of the MNA component of the remedy may be required. The wells to be utilized, monitoring parameters, monitoring schedule, evaluation methods, reporting schedule, timeframe, and potential trigger conditions for remedy re-evaluation will be developed and specified during the Remedial Design discussed in Section 10.0.

- Institutional controls, including deed notices, ordinances, restrictive covenants, and other applicable measures, which would apply to the entirety of the Facility property. Notices would be used to provide information to potential future buyers of the Facility property of the presence and location of Perched Zone COCs. Controls would limit activities that could disturb Perched Zone soils or groundwater. Any activity that would include such a disturbance would require a work area-specific characterization of COCs in the affected area, as well as utilization of personnel and methods appropriate for work with soils containing chemical contaminants. Soils or groundwater generated from any such activities would be managed in a manner that complied with state and federal regulations.

In addition, institutional controls would impose requirements for any new construction within the limited on-site areas shown on Figure 4 where there is the potential for unacceptable vapor intrusion risks. Within these areas, the design and construction of any new buildings or similar enclosed structures would have to include controls to limit the intrusion and accumulation of VOC vapors from underlying Perched Zone groundwater. The controls could include, but would not be limited to an assessment of soil vapor levels at the specific location of the planned structure, the construction of passive venting systems for crawlspaces, the exclusion of basements, and/or the use of vapor barriers and VOC sensor/alarm systems.

The following alternative remedies were considered for Perched Zone groundwater, but were not selected:

- No further action – This scenario would reduce remedy costs, but could potentially allow uncontrolled exposures to groundwater COCs at levels above risk thresholds. This was considered an unacceptable remedy outcome that was inconsistent with remedy objectives.

- Hydraulic control – Use of pumping or other control measures to address Perched Zone groundwater quality impacts would be difficult given the small radius of influence that would likely result from any well or other pumping center. Such control is also considered likely to be unnecessary, since the low groundwater velocities in the Perched Zone make any significant lateral COC migration unlikely.

- In situ chemical oxidation or enhanced biodegradation – Both of these techniques would rely on the delivery of an amending solution into saturated soils, in order to change the chemical environment of the water-bearing zone. The low hydraulic conductivity of the Perched Zone would make it difficult, possibly impracticable, to effectively deliver such solutions in the Perched Zone matrix. The potential for success of these measures is considered low, and the potential costs comparatively very high.

6.3 ALLUVIAL AQUIFER GROUNDWATER

The hydrogeologic characteristics of the Alluvial Aquifer are explained in detail in Section 4.0 of the FI Report. In general, the Alluvial Aquifer is an unconfined, highly transmissive continuous unit extending from approximately 45 to 150 feet bgs. This unit consists predominantly of sand, with interbeds of coarser materials that likely act as preferential pathways for groundwater and dissolved-phase COC migration. The groundwater gradient in this aquifer is to the south-southeast toward the Industrial Park and agricultural properties. Although the Alluvial Aquifer is locally used for groundwater supply, all known use in the vicinity of the Facility is for agricultural irrigation rather than domestic or drinking water purposes.

The primary COC present in off-site Alluvial Aquifer groundwater is 1,2-DCA. Given its extent and the concentrations present, 1,2-DCA will likely be the primary COC driver for groundwater management decisions at the Facility, both on- and off-site, for the duration of the Alluvial Aquifer remedy performance.

A small number of detections of other chemicals were observed in off-site wells at concentrations above risk screening criteria (Table 4 and Figure 5), but these are either not believed to be related to releases at the facility, or at levels too low to affect remedy selection and implementation. Specifically, these detections were as follows:

- A single off-site exceedance of chromium at OFF-MW-9, at 145 µg/l. This is much higher than any groundwater detection of this metal on-site. Given this, as well as the distance of this well from the Facility, this detection is not considered likely to represent impact from Facility release.

- A single off-site exceedance of bis(2-Ethylhexyl) phthalate at OFF-MW-9, at 300 µg/l. Again, this is much higher than any groundwater detection of this compound on-site. In addition, this compound is commonly observed as an artifact of sampling or analytical procedures. Given these factors, as well as the distance of this well from the Facility, this detection is also not considered likely to represent impact from a Facility release.

- Very low concentrations of bis(2-chloroethyl) ether at the OFF-MW-3 and OFF-MW-7 well locations and chloroform at OFF-MW-9. These COCs were present below quantitation limits, and were only slightly above risk screening criteria.

A plume of 1,2-DCA in the Alluvial Aquifer has been historically documented as extending beyond the southeastern property boundary of the Industrial Park, which is located approximately 2,700 feet from the nearest Facility boundary. An updated delineation of the boundary of this plume beyond the Industrial Park was not undertaken as a part of the FI because of litigation filed by the subject property owner.

As noted above, Alluvial Aquifer COCs are believed to derive from Perched Zone groundwater and COCs leaking to the deeper zone. Perched Zone groundwater impacts, in turn, are likely caused by COC migration from source area soils.

As discussed in the risk screening analysis (Section 5), COCs (primarily 1,2-DCA) in Alluvial Aquifer groundwater exceeds the risk-based screening level for ingestion (Figure 5). One specific intent of the recommended remedies, therefore, is to limit exposures by controlling the use of Alluvial Aquifer groundwater for this purpose within the exceedance area.

The recommended remedies for Alluvial Aquifer groundwater are:

- MNA and source control – As noted above and discussed in the FI, primary lines of evidence indicate that COCs are already attenuating naturally within the Alluvial Aquifer. In addition, the stabilization of soils at the Former Dinoseb Disposal Ponds and Pump Shop and the use of SVE at Unit 6 should enhance the attenuation process by reducing sources of groundwater COCs.

  The implementation of MNA for the Alluvial Aquifer will follow the process described for the Perched Zone groundwater in Section 6.2 above. As a part of this implementation, access will be requested for the property downgradient of the Industrial Park (the Stephens Property) for the installation of wells to monitor the distal portion of the plume. Alternatively, wells may be placed at the nearest downgradient public right of way or easement to provide for that downgradient (sentry) monitoring. If delineation and monitoring in either location indicates that the 1,2-DCA plume is expanding, then the MNA remedy may be re-evaluated or modified to address specific areas of concern.

- Institutional Controls – Deed notices, ordinances, restrictive covenants, or similar restrictions, will be imposed on all on- and off-site areas where Alluvial Aquifer groundwater exceeds applicable risk thresholds for 1,2-DCA, subject to landowner concurrence on off-site properties. Deed notices will inform any future buyers of the presence of COCs in groundwater on the subject property, as well as providing information regarding the limitations on use and related controls that would apply to that groundwater. Controls will prohibit the use of Alluvial Aquifer groundwater for drinking water supply within the controlled areas. In addition, any drilling to or through the Alluvial Aquifer within the controlled area must utilize procedures that will minimize the transfer of COCs to deeper aquifers. Such drilling will also comply with applicable health and safety regulations related to potential worker contact with COCs in groundwater, and with waste management regulations. Figure 5 exhibits the known current extent of anticipated Alluvial Aquifer institutional controls.

The following alternative remedies were considered for Alluvial Aquifer groundwater, but were not selected:

- No further action – This scenario would reduce remedy costs, but could potentially allow uncontrolled exposures to groundwater COCs at levels above risk thresholds. This was considered an unacceptable remedy outcome that was inconsistent with Remedy objectives.

- Hydraulic control – Given the potential lateral and vertical extent of the plume, and the highly productive nature of the Alluvial Aquifer, hydraulic control would require the pumping of very large quantities of groundwater. That groundwater would then require treatment and discharge or re-injection. The magnitude of such an effort would render it impracticable. In addition, hydraulic control would not result in a more protective or permanent remedy for the Alluvial Aquifer than would be provided by the on-site source control remedies and MNA in the Alluvial Aquifer. Consequently, hydraulic control is not considered to be either necessary or cost effective.

- In situ chemical oxidation or enhanced biodegradation – As with hydraulic control, the complexity and cost of such an approach would be excessive and would result in little, if any, benefit in terms of effectiveness and permanence of remedy. Consequently, source control, MNA, and exposure controls were considered a more practicable approach.

6.4 SOIL AND GROUNDWATER REMEDY TERMINATION

Institutional controls (other than ordinances) will remain in place at a given property until COC levels within the media (i.e., soil, Perched Zone groundwater, Alluvial Aquifer groundwater) governed by that control have declined below applicable risk thresholds. These may be risk screening criteria, or other criteria developed through either a supplemental risk assessment process or another appropriate process. MNA will continue until concentrations of COCs within the monitored groundwater zone that exceed applicable risk thresholds are both stable in extent and limited to on-site areas, unless another endpoint is established that is protective of human health and the environment.

7.0 RECOMMENDATIONS FOR REMOVAL OF SITE STRUCTURES

With the exception of the Main Office and the large Warehouse buildings (Figure 7) (requested by ADEQ to remain in place for potential future use), and prior to construction of the soil cover described in Section 6.1, all aboveground portions of buildings, process units, tank systems, and related site structures at the Facility will be demolished or deconstructed. Slab foundations or similar at-grade and below-grade portions of these structures will remain in place to be incorporated into the soil cover system. If any of these foundations or similar structures contain sumps, major failures, or other related breaches in their integrity, these will be permanently sealed as a part of the demolition/deconstruction process. In addition, storm grates, drains, and piping running beneath the demolition and soil cover area will be permanently plugged.

To the extent practicable, any portion of the structures that can be readily recycled will be salvaged. This stipulation applies primarily to the metal portions of the process units. Any non-salvaged materials will be managed as demolition debris. This management will include characterization and disposal at an appropriate off-site disposal facility, unless an acceptable alternative strategy is identified.

This Section does not apply to the Drum Vault and the Wastewater Treatment Ponds, which are discussed separately in Sections 8.0 and 9.0, respectively, of this FS.

8.0 RECOMMENDED REMEDY FOR DRUM VAULT

The Drum Vault is located in the central area of the Facility (Figure 2). Based on the FI evaluation, the Drum Vault contains both crushed drums and intact drums in poor condition, and approximately 4-6 feet of water-saturated sandy backfill. Although the contents of the drums were not identified, waste materials were visibly present in the drums. Analysis of the backfill and vault water identified several COCs at concentrations that exceeded a regulatory level.

Based on the presence of water contained in the Drum Vault at an elevation above the normal water table, the structure currently provides some degree of containment, limiting the release of COCs from within the Drum Vault. When the containment currently provided by the Drum Vault ultimately fails, however, it could result in a new release of COCs to the environment. This would reduce the effectiveness of on-going remedy efforts, and possibly result in an unacceptable exposure scenario. Given this, the recommended remedy for the Drum Vault is the removal of its contents for off-site disposal.

This remedy would consist of:

- Demolition and removal of the above-grade portion of the overlying warehouse building.
- Removal of the concrete slab (i.e., the warehouse floor slab) that covers the Drum Vault.
- Dewatering of the Drum Vault backfill. All water will be stored and characterized for appropriate disposal. If its quality permits, it may be placed into the POTW inlet at the Facility, subject to the concurrence of the POTW operator.
- Transferring the drums or drum portions and backfill in bulk from the Drum Vault to lined transport trucks. Based on the observed condition of the drums, individual drum removal is not anticipated to be feasible or necessary. If the Drum Vault contents are determined to be non-hazardous waste, they may be stabilized with flyash, Portland cement, or similar materials prior to removal.
- Cleaning any residual drum, waste, or backfill material from the Drum Vault.
- Backfilling the Drum Vault with clean, low permeability fill.

The removal of the Drum Vault is considered a final remedy with long term effectiveness, and is protective of human health and the environment. It is also consistent with the other remedy elements being implemented in on-site areas.

The following alternative remedies were considered for the Drum Vault, but were not selected:

> No further action – This scenario would reduce remedy costs, but would leave a body of waste materials in place in a manner that could eventually result in a new release. This was considered an unacceptable remedy outcome that was inconsistent with remedy objectives.

> Waste stabilization – Under this approach, the drums, drum contents, and backfill would be mixed with a stabilizing material to reduce the mobility of COCs, as well as to reduce the presence of free water within the Drum Vault. This approach was considered less practicable than the bulk removal of the contents, because the heterogeneous nature of the materials would make selection of appropriate stabilizing agents and mixing of those agents difficult. On balance, given the characteristics of the vault as a defined and limited structure, and even though a stabilization approach could be less expensive, a removal-based approach was considered more practicable and permanent.

9.0 RECOMMENDED REMEDY FOR WASTEWATER TREATMENT PONDS

The current Wastewater Treatment Ponds (WWTP) are located south of Industrial Park Road (Figure 2). These ponds were constructed in 1977 and comprise the wastewater/storm water treatment system for the facility. The system consists of an API Separator, Flow Equalization Basin, Aeration Basin, two Clarifiers and a Polish Pond. Currently, these ponds receive storm water drainage from the entire facility. The effluent from the system is pumped 4.5 miles through an 8-inch line to a permitted outfall at the Mississippi River.

A characterization of the pond waters and sediments was not included in the FI scope—since these ponds continue to be used by ADEQ, any findings from such a characterization would have been subject to change based on future use. The FI did include, however, an evaluation of Perched Zone groundwater at the pond system. 1,2-DCA was present, but at concentrations much lower than those observed in the Perched Zone beneath process areas. Based on these data, the ponds are not considered a significant source of groundwater impact.

The recommended remedy for the WWTP is removal of the free liquids, removal or stabilization of the sediments/sludge, and regrading of the pond area to shed storm water to appropriate drainage ditches, and revegetating the regraded surface. All ancillary structures, piping, and equipment will be decommissioned and removed, unless needed for future storm water management or other use.

The decision on removal for off-site treatment and/or disposal vs. in place stabilization of the sediments/sludge will be made as a part of the Remedial Design process (Section 10.0). This decision will be based on physical and chemical characterization of the pond sediments at the time of pond closure, as well as any bench or pilot scale testing needed to finalize design decisions. Contingent upon characterization of pond waters at the time of closure, and with the approval of the POTW operator, these waters may be placed into the inlet of the local POTW.

Closure of these ponds should be performed at the conclusion of the demolition/deconstruction, soil cover, and soil source control remedy elements. In the interim, storm water from the site would continue to be managed in the WWTP.

The following alternative remedies were considered for the WWTP, but were not selected:

> No further action – This scenario would reduce remedy costs, but would leave in place pond waters and sediments that may contain COCs at unacceptable levels, and also could require continued, long-term management. This was considered an unacceptable remedy outcome that was inconsistent with remedy objectives.

Continued use – Under this scenario, the WWTP would continue to be used for storm water management by future site users, for an undefined period of time. Future users, however, might decline to manage and use the WWTP. Therefore, this goal may not meet the remedy objective of achieving unmonitored discharge of storm water from the Facility.

10.0 REMEDIAL DESIGN WORKPLAN

This FS recommends a suite of engineering and institutional controls that would cost-effectively meet the remedy objectives discussed in Section 4.0. The FS is not intended, however, to address all data needs associated with implementing the recommended remedies at the site. Particularly with respect to the engineering controls, additional work will be required to provide the level of detail required for such implementation. This additional work is considered to fall generally within the ambit of Remedial Design, and would include, but not be limited to, the following:

- Detailed description of site controls to be implemented during the various remedy activities.
- Identification of and compliance with requirements for regulatory permits and approvals.
- Bench scale and pilot scale testing to finalize the SVE system design, selection of stabilizing material and method, and other remedy activities.
- Description of any additional sampling, analysis, or monitoring of environmental media, including soil, groundwater, surface water, and air, required for remedy design or implementation.
- Final characterization of any wastes to be generated during the drum vault removal, soil stabilization, or other remedy activities, particularly with respect to hazardous vs. non-hazardous, as well as selection of a location and mode of disposition for those wastes.
- Preparation of engineering design and specification documents as needed to contract the construction, operation, maintenance, and/or performance of remedy elements.
- Identification of any requirements for public notice or interaction associated with remedy design or implementation.
- Possible performance of focused human health and/or ecological risk assessments to address specific COCs and their role in future remedy decisions.
- Specific design and implementation deliverables to be provided to the ADEQ, with an associated schedule.

Upon approval of the FS by ADEQ, it is recommended that a Remedial Design Workplan (RDWP) be developed to describe the performance of these remedial design elements. Depending on the outcome of pilot scale or bench scale testing, permitting, risk assessment, or other design-related factors, it may be necessary to modify the recommended remedies for the Facility, or to recommend different remedies entirely. Should this become necessary, the changes in recommended remedy elements, together with the basis for the change, will be submitted to ADEQ for their review and approval.

11.0 ESTIMATED REMEDY COSTS

Table 5 presents the estimated capital, annual operating, and decommissioning costs for the remedy elements, with a detailed breakdown of the development of these costs. Final project costs will vary from these cost estimates and will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, the implementation schedule, and other variables. A breakdown of the costs developed for specific remedy elements is included as Appendix B of this FS.

In particular, the following cost items could potentially have a major impact on the overall remedy costs, and represent significant uncertainty in the estimate of those costs:

- Demolition/deconstruction costs and salvage value – The estimate for demolition was based on discussions with a single demolition contractor (other contractors were contacted but did not respond). Time constraints did not allow that contractor to actually visit the Facility, so the rough estimate they provided was based on their review of maps and aerial photographs. The actual demolition/deconstruction costs may vary considerably from this estimate. In addition, the salvage value of Facility metals and other materials can only be developed after the completion of extensive surveys and testing by salvage specialists. These efforts will be performed as part of the Remedial Design process described in Section 10.0 of this FS. A salvage value of 25 percent of the demolition/deconstruction cost was assumed for preliminary cost estimation purposes only. The actual salvage value may also vary considerably from this estimate.

- Waste characterization issues – with respect to the Drum Vault removal, WWTP closure, and other remedy elements, and based on the available sampling data, the remediation wastes that may be generated are assumed to be non-hazardous (Class 1 Industrial). Costs for waste management, permitting, and disposition would increase substantially if significant proportions of the waste are determined to be hazardous. Such a determination could require re-evaluation of remedy recommendations.

The estimated total capital cost is $8,486,400.00, with an annual operating and maintenance cost, including monitoring, of $155,855.00. Decommissioning, including removal of the SVE system, as well as SVE and monitoring wells plugging and abandonment, is estimated at $210,344.00. As noted above, the actual costs may vary from this estimate, depending on actual contractor bids, remedial design decisions, currently unknown field conditions, and other factors; pending the development of final costs, this estimate should be considered a guideline.

Tables

Table 1
Constituents in On-Site Soils Exceeding Risk Based Screening Levels Based on Direct Contact with Chemicals
Cedar Chemical Corporation

Chemicals Exceeding More Protective RBC	Industrial Worker (mg/kg)	Construction Worker (mg/kg)	More Protective RBC (mg/kg)	Basis for More Protective RBC
Aldrin	1.01	9.66	1.01	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
Dieldrin	1.08	10	1.08	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
Dinoseb	616	238	238	Hazard quotient of 1 for construction worker
gamma-Hexachlorocyclohexane (gamma-BHC)	20.6	173	20.6	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker

mg/kg - Milligrams Per Kilograms
RBC - Risk-Based Concentrations
Comparison performed for soils in 0-10 ft. depth range

Table 2
Constituents in On-Site Perched Zone Groundwater Exceeding Risk Based Screening Levels Based on Vapor Intrusion into On-Site Industrial Building
Cedar Chemical Corporation

Chemicals Exceeding RBC	RBC (µg/l)	Basis for RBC
1,2-Dichloroethane	14,840	Excess lifetime cancer risk of 1×10^{-5}
Chloroform	13,000	Excess lifetime cancer risk of 1×10^{-5}
m and p-Xylenes	161,000	Solubility Limit

µg/l - Microgram/Liter
RBC - Risk-Based Concentrations

Table 3
Constituents in On-Site Alluvial Aquifer Groundwater Exceeding Risk Based Screening Levels
Based on Ingestion
Cedar Chemical Corporation

Chemical	Number of Detections	Number of Analyses	Maximum Detected Concentration (µg/l)	Maximum Contaminant Level (µg/l)	Does Maximum Detected Concentration Exceed MCL?	*USEPA Region 6 Tap Water Screening Level (2007 value) (µg/l)	Does Maximum Detected Concentration Exceed Tap Water Screening Level?	Higher of MCL/Tap Water Screening Level (µg/l)
Arsenic	29	29	152	10	YES	0.045	YES	10
Benzene	5	29	21	5	YES	0.35	YES	5
bis(2-Chloroethyl) ether	5	29	41	NA	no	0.0098	YES	0.0098
4-Chloroaniline	9	29	3000	NA	no	150	YES	150
Chlorobenzene	11	33	310	100	YES	91	YES	100
1,2-Dichlorobenzene	16	58	1100	600	YES	49	YES	600
1,2-Dichloroethane	15	29	4900	5	YES	0.12	YES	5
Aldrin	4	29	0.053	NA	no	0.004	YES	0.004
Chloroethane	4	29	11	5	YES	4.3	YES	5
Aniline	3	29	18	NA	no	12	YES	12
1,3-Dichlorobenzene	2	58	90	NA	no	14	YES	14
Vinyl chloride	2	29	10	2	YES	0.015	YES	0.015
Chloroform	1	29	0.43	NA	no	0.17	YES	0.17

µg/l - Microgram/Liter
NA - not available
*USEPA Region 6 Human Health Medium-Specific Screening Levels (MSSLs) (12/4/2007)

Table 4
Constituents in Off-Site Alluvial Aquifer Groundwater Exceeding Risk Based Screening Levels Based on Ingestion
Cedar Chemical Corporation

Chemical	Number of Detections	Number of Analyses	Maximum Detected Concentration (µg/l)	Maximum Contaminant Level (µg/l)	Does Maximum Detected Concentration Exceed MCL?	*USEPA Region 6 Tap Water Screening Level (2007 value) (µg/l)	Does Maximum Detected Concentration Exceed Tap Water Screening Level?	Higher of MCL/Tap Water Screening Level (µg/l)
bis(2-Ethylhexyl) phthalate	5	23	300	6	YES	4.8	YES	6
Chromium	14	23	145	100	YES	NA	no	100
1,2-Dichloroethane	13	23	19000	5	YES	0.12	YES	5
bis(2-Chloroethyl) ether	2	23	4.6	NA	no	0.0098	YES	0.0098
Chloroform	1	23	0.5	NA	no	0.17	YES	0.17

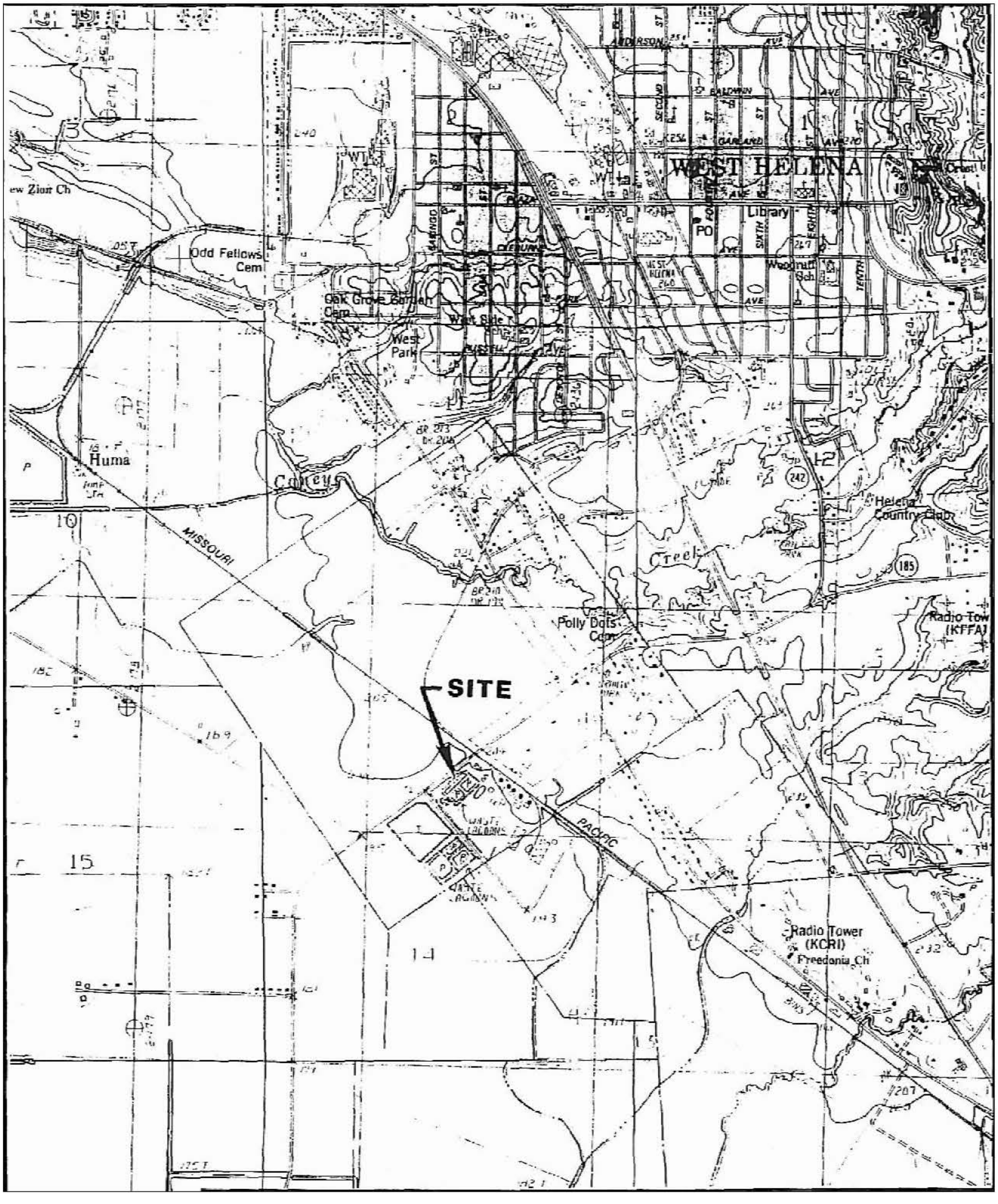
µg/l - Microgram/Liter
NA - not available
*USEPA Region 6 Human Health Medium-Specific Screening Levels (MSSLs) (12/4/2007)

Table 5
Preliminary Estimate of Remedy Design and Implementation Costs
Cedar Chemical Corporation
Helena-West Helena, Arkansas

	Capital Cost	Annual Cost	Decommissioning Costs
Remedial Design/Workplan	$ 383,660		
Drum Vault Closure	$ 742,996		
SVE System Construction & Installation	$ 199,924		
Soil Cover (pavement and geotextile/soil)	$ 2,221,360		
Facility Process Unit and Building Demolition With Salvage	$ 3,692,430		
Former Dinoseb Disposal Pond Soil Stabilization	$ 612,261		
SVE System Operations & Maintenance		$ 54,475	
Monitored Natural Attenuation Sampling and Reporting		$ 101,380	
Additional Monitoring Well Installations	$ 53,450		
Decommissioning of SVE System and Monitoring Wells			$ 210,344
Future Wastewater Treatment Pond Closures (stabilization in place)	$ 963,980		
Totals	**$ 8,486,400**	**$ 155,855**	**$ 210,344**

Notes:
1. Costs are preliminary estimates only, actual costs may vary based on remedial design, mode of implementation of the remedy, waste characterization, market costs at the time of implementation, or other factors.
2. Costs do not include legal expenses, payments to property owners, or other administrative costs.
3. Costs are in 2009 U.S. dollars, and are not adjusted for the future value of money, inflation, or similar factors.
4. Costs do not include storm water permitting or annual costs associated with storm water discharge, as it is assumed these will be borne by the site owner/operator.
5. Costs do not include any additional assessment, other than completion of delineation of 1,2-DCA to the southeast of the Industrial Park.
6. Costs do not include any contingency.
7. Costs may be lower than estimated if certain field tasks are combined.

FIGURES



SOURCE: EnSafe, Phase II Investigation Report, 1995

SITE LOCATION MAP

Cedar Chemical
Helena-West Helena, Arkansas

AMEC Geomatrix	Project 13636	Figure 1

I:\13636 - Arkansas Helena-West Helena\2007 CCR\FINAL FIGURES\ FIG 1 Site Location Map\FIG 1.dwg

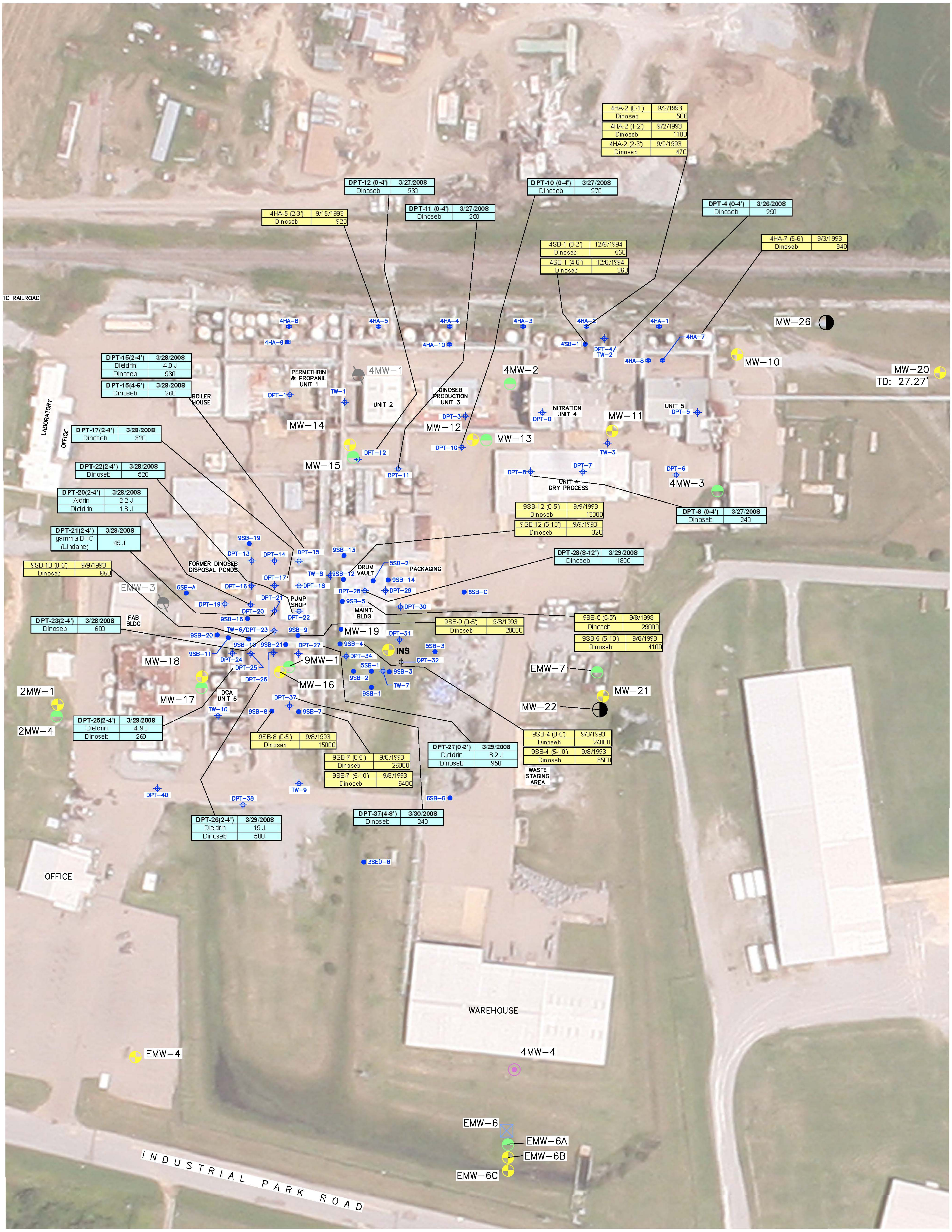
BASEMAP MODIFIED FROM:
Smith & Weiland/Cline-Fraizer Survey, August 2008

0 80
APPROXIMATE SCALE IN FEET

Facility Structure Locations

Cedar Chemical
Helena-West Helena, Arkansas

By: MLS	Date: 7/25/09	Project No. 13636
AMEC Geomatrix		Figure 2



BASEMAP MODIFIED FROM:
Smith & Weiland/Cline-Fraizer Survey, August 2008

Risk Screening Criteria:
All soil COCs were compared to USEPA 2007 Outdoor Worker Soil screening levels. Risk Based Screening Levels were developed from this comparison.

Analyte	Most Conservative Risk Based Screening Level (mg/kg)
Aldrin	1.01
Dieldrin	1.08
gamma-BHC (Lindane)	20.6
Dinoseb	238

EXPLANATION

Data from FI Report
Data from CCR Report

9SB-12 (5-10') 9/9/1993 Dinoseb 320

Sample ID with Depth — Sample Date — Concentration of Analytes Detected Above RBSL

All soil analytical results shown are in milligrams per kilogram (mg/kg).

J Estimated concentration for analyte.

- Perched Well Location
- Upper Alluvial Well Location
- Middle Alluvial Well Location
- Lower Alluvial Well Location
- CMT Well with multiple completions (depths noted above)
- Plugged and Abandoned Well
- DPT Soil Sample Location

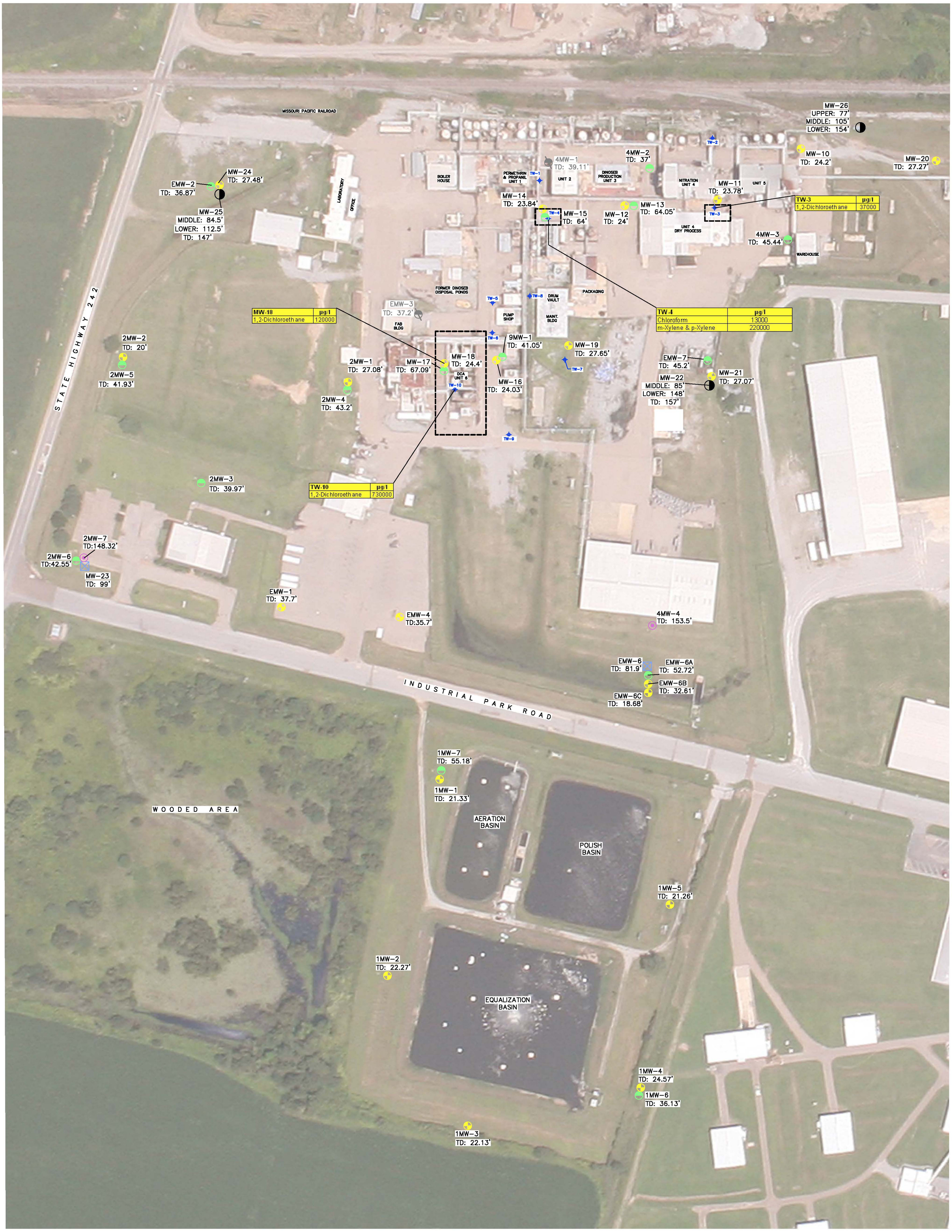
0 50
APPROXIMATE SCALE IN FEET

Constituents of Concern Above Risk Based Screening Levels in On-Site Soils

Cedar Chemical
Helena-West Helena, Arkansas

By: MLS | Date: 7/25/09 | Project No. 13636

AMEC Geomatrix | Figure 3



BASEMAP MODIFIED FROM:
Smith & Weiland/Cline-Fraizer Survey, August 2008

EXPLANATION

Risk Screening Criteria:
All groundwater COCs were compared to USEPA 2007 groundwater screening levels. Risk Based Screening Levels were developed from this comparison.

COC	Vapor Intrusion Risk Based Screening Level (µg/l)
1,2-Dichloroethane	14840
Chloroform	8900
m-Xylene & p-Xylene	161000

Perched Well Location

Upper Alluvial Well Location

Middle Alluvial Well Location

Lower Alluvial Well Location

CMT Well with multiple completions (depths noted above)

Plugged and Abandoned Well

DPT Temporary Well Groundwater Sample Location

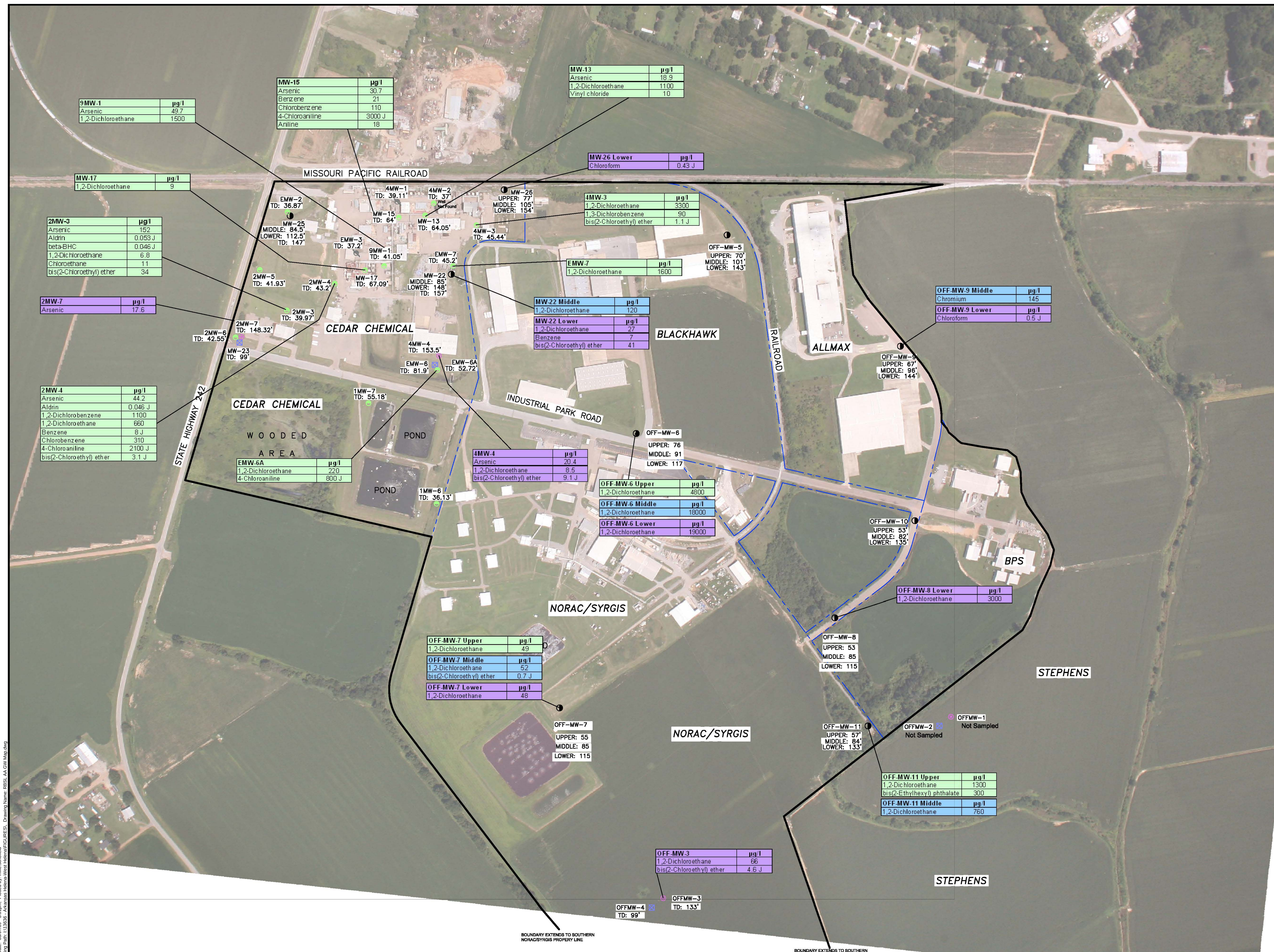
Boundary of Institutional Controls based on Vapor Intrusion Risks.

0 80
APPROXIMATE SCALE IN FEET

Constituents of Concern Above Vapor Intrusion-Based Risk Screening Levels in Perched Zone Groundwater

Cedar Chemical
Helena-West Helena, Arkansas

By: MLS	Date: 7/25/09	Project No. 13636
AMEC Geomatrix		Figure 4



EXPLANATION

- Upper Alluvial Well Location
- Middle Alluvial Well Location
- Lower Alluvial Well Location
- CMT Well with multiple completions (screen depths noted)
- Plugged and Abandoned Well
- Known Boundary of Institutional Controls Based on Groundwater Ingestion

- Upper Alluvial Aquifer
- Middle Alluvial Aquifer
- Lower Alluvial Aquifer

Concentrations reported are from the most recent sampling event (Fall 2008).

Risk Screening Criteria:
All groundwater COCs were compared to higher of applicable USEPA 2007 Tapwater Media Specific Screening Level and MCL.

COC	Higher of MCL/Tap Water Screening Level* (µg/l)
1,2-Dichlorobenzene	600
1,2-Dichloroethane	5
1,3-Dichlorobenzene	15
4-Chloroaniline	150
Aldrin	0.004
Aniline	12
Arsenic	10
Benzene	5
beta-BHC	0.037
bis(2-Chloroethyl) ether	0.0098
bis(2-Ethylhexyl) phthalate	6
Chlorobenzene	100
Chloroethane	3.9
Chloroform	0.17
Chromium	100
Vinyl chloride	2

* 2007 USEPA Screening Table

0 125 250
Approximate Scale in Feet

Constituents of Concern Above Ingestion-Based Risk Screening Level in Alluvial Aquifer Groundwater

Cedar Chemical
Helena-West Helena, Arkansas

By: MLS | Date: 7/25/09 | Project No. 13636.000

AMEC Geomatrix | Figure 5

Plot Date: 08/07/09 - 3:31pm, Plotted by: mike.schofield
Drawing Path: I:\13636 - Arkansas Helena-West Helena\FIGURES\, Drawing Name: RBSL AA GW Map.dwg

/07/09 RBSL AA GW Map.dwg

BASEMAP MODIFIED FROM:
Smith & Weiland/Cline-Fraizer Survey, August 2008

EXPLANATION

- Perched Well Location
- Upper Alluvial Well Location
- Middle Alluvial Well Location
- Lower Alluvial Well Location
- CMT Well with multiple completions (depths noted above)
- Plugged and Abandoned Well
- DPT Groundwater Sample Location
- **<0.82** 1,2-DCA not detected above detection limit shown
- **5300** Concentration of 1,2-DCA Detected
- 1,2-DCA Isoconcentration Contour

All results shown are in micrograms per liter (ug/l).

TW- samples were collected in March/April 2008 during the DPT Investigation.

J Estimated concentration for analyte.

INS - Well not sampled due to insufficient water (<1 foot)

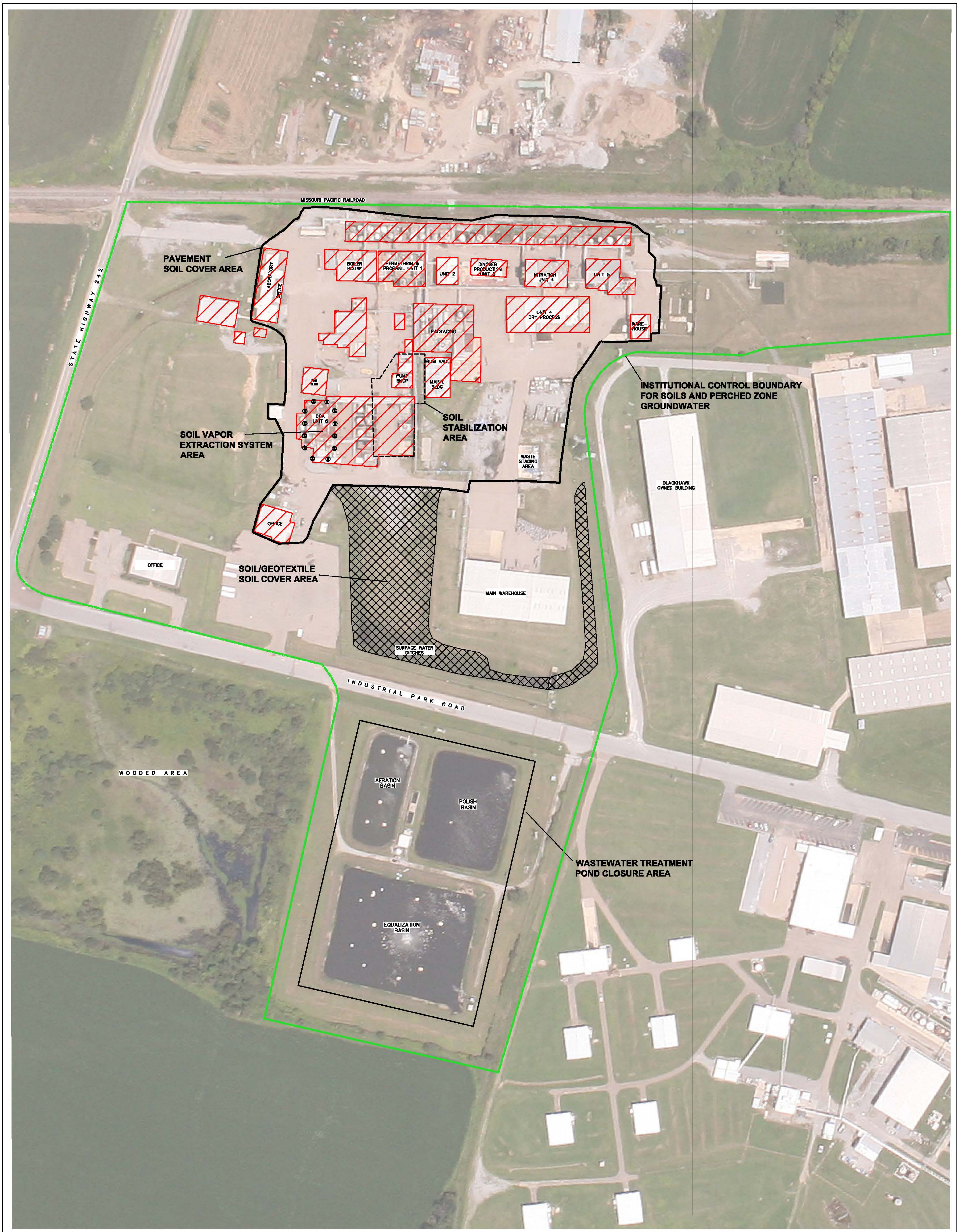
NA - Not Analyzed

0 80
APPROXIMATE SCALE IN FEET

1,2-Dichloroethane in
Perched Zone Groundwater
September 2008

Cedar Chemical
Helena-West Helena, Arkansas

By: MLS	Date: 7/25/09	Project No. 13636
AMEC Geomatrix	Figure 6	



BASEMAP MODIFIED FROM:
Smith & Weiland/Cline-Fraizer Survey, August 2008

EXPLANATION

SOIL VAPOR EXTRACTION WELL

BUILDINGS TO BE REMOVED

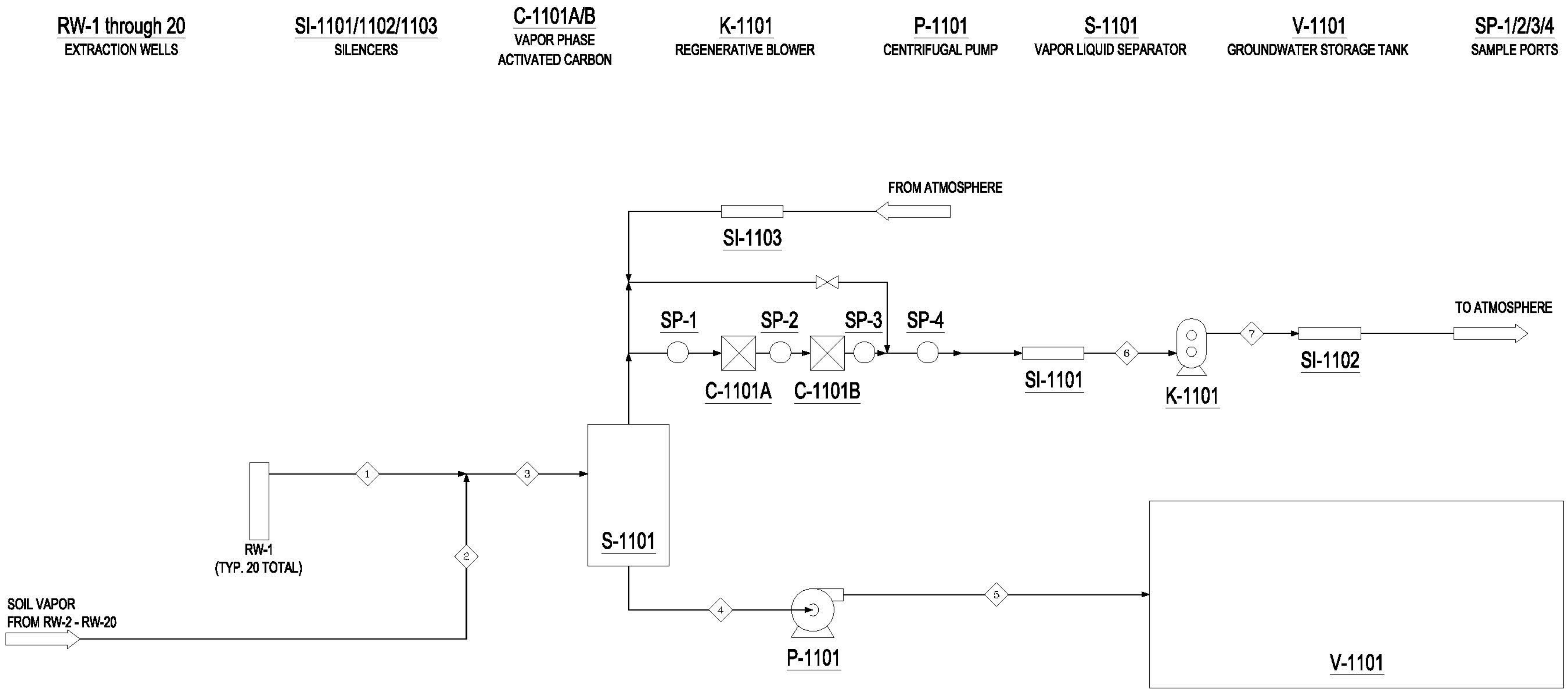
0 100
APPROXIMATE SCALE IN FEET

NOTE: Boundaries, well locations, and remedy elements subject to change based on Remedial Design or other factors.

ON-SITE REMEDY ELEMENTS

Cedar Chemical
Helena-West Helena, Arkansas

By: MLS	Date: 7/25/09	Project No. 13636
AMEC Geomatrix		Figure 7



Schematic of Soil Vapor Extraction System

Cedar Chemical
Helena - West Helena, Arkansas

By: BAL/JCB	Date: 7/25/09	Project No. 13636.000
AMEC Geomatrix		Figure 8

Plot Date: 08/07/09 - 3:19pm, Plotted by: mike.schofield
Drawing Path: I:\13636 - Arkansas Helena-West Helena\FIGURES\, Drawing Name: Process Flow Diagram.dwg

APPENDIX A

Center for Toxicology and Environmental Health Human Health Risk Screening Report

Center for Toxicology and Environmental Health, L.L.C.

5120 North Shore Drive North Little Rock, AR 72118 Phone: 501.801.8500 Fax: 501.801.8501 www.cteh.com

Derivation of Human Health Risk-Based Concentrations Soil and Groundwater

Cedar Chemical Corporation Helena-West Helena, Arkansas

August 2009

Prepared for:
Arkansas Department of Environmental Quality

Prepared by:
Center for Toxicology and Environmental Health, L.L.C.

Project Number: 9297

Table of Contents

Tables

Attachments

1.0 INTRODUCTION

Past and recent investigations conducted at the former Cedar Chemical Corporation Facility (Site) have identified various organic chemicals in on-site soil and in on-site and off-site groundwater. Historically, constituents consistently found in environmental media at the site have included: ketones, pesticides, herbicides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs). Certain constituents have migrated in groundwater beyond the Site boundary.

The Center for Toxicology and Environmental Health, LLC (CTEH) was contracted to development human health risk-based concentrations (RBCs) for those chemicals detected in on-site soils and on-site and off-site groundwater above USEPA Region 6 soil and groundwater screening levels. Note that USEPA Region 6 Human Health Medium-Specific Screening Levels (Maximum Contaminant Levels for drinking water, residential screening levels for water, and industrial outdoor worker screening levels for soil; collectively referred to as screening levels; SLs) were used to screen and select chemicals of potential concern (COPCs). The generic USEPA Region 6 screening levels are distinct from site-specific risk-based concentrations (RBCs) calculated in this report. The RBCs calculated in this report are used to evaluate the need for possible remediation of the soil and groundwater at the Site.

2.0 DATA EVALUATION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPCs)

Groundwater data considered in this assessment are from the 2008 Facility Investigation Report (AMEC Geomatrix, 2009). Soil data are compiled from the Current Conditions Report (Geomatrix, 2007) and the Facility Investigation Report. Chemicals of potential concern (COPCs) in this report were identified by comparing detected concentrations with USEPA health-protective screening levels presented in USEPA's Region 6 Human Health Medium Specific Screening Levels (USEPA, 2007). The selection of COPCs for groundwater and soil is discussed below.

2.1 Groundwater COPCs

At least two groundwater zones, the perched and alluvial groundwater zones, are known to exist at the Site. Both the perched and alluvial zones have been sampled on-site, whereas sampling results are available only for off-site groundwater in the alluvial zone. The evaluation of COPCs for groundwater is organized into chemicals detected in on-site perched groundwater (Table 1) and chemicals detected in on-site and off-site alluvial zone groundwater (Tables 2A and 2B, respectively).

Although perched groundwater and alluvial groundwater are not used for potable purposes at the Site, maximum concentrations of chemicals detected in groundwater were initially compared to United States Environmental Protection Agency (USEPA) Regional Maximum Contaminant Levels (MCLs) for drinking water and residential screening levels (residential SLs) (USEPA, 2007). COPCs are defined as those chemicals detected in perched on-site groundwater (Table 1), alluvial on-site groundwater (Table 2A), and alluvial off-site groundwater (Table 2B) that exceed either the MCL and the residential SLs presented in USEPA Region 6 Screening Levels table (USEPA, 2007). For chemicals with both an MCL and a residential SL, the MCL was used for screening COPCs. The alluvial groundwater data evaluated in this report were limited to the September 2008 and November 2008 sampling rounds. These groundwater data are the most representative of current conditions at the Site.

Chemicals detected in perched or alluvial groundwater at concentrations above an MCL or residential SL were selected as COPCs and considered for possible determination of a site-specific risk-based concentration (RBC) in groundwater. RBCs were derived for the on-site (Table 5) and off-site (Table 6) vapor intrusion pathways. These pathways of exposure to chemicals of potential concern in groundwater are explained further in Section 3 of this report. For reasons described in Section 3 of this report, possible exposure to chemicals volatilizing from use of off-site groundwater was not evaluated in this report.

2.2 Soil COPCs

USEPA industrial outdoor worker soil SLs were used to select COPCs in soil. Because an on-site worker is unlikely to directly contact chemicals in soil deeper than 10 feet below ground surface (bgs), selection of COPCs for soil was limited to the 0 to 10 feet bgs soil profile. Summary statistics for chemicals detected in 0 to 10 feet bgs soils are presented in Table 3. Although arsenic exceeded USEPA soil SLs, it was not selected as a COPC based on conclusions reached in the Current Conditions report indicating that soil arsenic levels are consistent with background or may result from agricultural practices. Tetrachloroethene was detected in one sample at a concentration of 2.1 mg/kg, only slightly above its USEPA Region 6 risk based worker screening level of 1.7 mg/kg. Because it was detected in only one sample at a concentration only slightly above its screening level, tetrachloroethene was not considered a COPC.

Based on the comparison of maximum detected chemical concentrations in soil to USEPA industrial outdoor worker soil SLs, the following chemicals were identified as COPCs for the derivation of RBCs in soil: aldrin, chlordane (technical), 1,2 dichloroethane, dieldrin, dinoseb, beta-hexachlorocycolhexane (beta-BHC), gamma-hexachlorocyclohexane (gamma-BHC or lindane), propanil, and toxaphene.

COPCs in soil were not selected based on groundwater protection criteria. However, for the sake of completeness, the soil data were also screened using groundwater protection-based soil screening levels in Table 4. The soil SL for protection of groundwater was multiplied by a dilution-attenuation factor (DAF) of 20 to account for the effect of dilution and attenuation on the chemical leaching from soil.

3.0 EXPOSURE ASSESSMENT

The objectives of the exposure assessment are to evaluate potential pathways of human exposure to COPCs in groundwater and soil at the Site. Once complete exposure pathways are identified (for example, ingestion of dieldrin in soil), site-specific risk-based concentrations (RBCs) are calculated for each potential receptor (such as a commercial/industrial worker). This section analyzes exposure conditions that may exist for current and future conditions at the site.

3.1 Characterization of Exposure Setting

The Facility is located to the south of the city of Helena-West Helena, in Phillips County, Arkansas. The Facility consists of 48 acres within the Helena-West Helena Industrial Park, approximately 1.25 miles southwest of the intersection of U.S. Highway 49 and State Highway 242. The Facility is bordered by farmland, State Highway 242, a rail spur, and industrial park properties. The former operational portion of the property is divided into two major areas: (1) the abandoned manufacturing area and (2) the wastewater treatment system area which is located on the south side of Industrial Park Road. Of the 48 acres, approximately 40 acres comprise the abandoned manufacturing area of the Site. The 40 acre portion of the property is fenced and guarded by an on-site security guard. The current wastewater treatment ponds are located on an additional 8 acres of the property. An undeveloped, wooded area west of the wastewater treatment ponds and south of Industrial Park Road is part of the site property, but does not appear to have historically been part of the manufacturing facility.

3.2 Exposure Pathway Analysis

As stated by the USEPA, an exposure pathway "describes the course a chemical or physical agent takes from the source to the exposed individual. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure" (USEPA, 1989).

An exposure pathway is made up of four elements. These are:

- A source and mechanism of chemical release,
- A retention or transport medium,
- A point of potential human contact with the contaminated medium, and;
- An exposure route at the contact point.

Exposure pathways to chemicals of potential concern in groundwater and soil are discussed by exposure medium.

3.2.1 Exposure Pathways to COPCs in Groundwater

Generally, persons may contact chemicals of potential concern in groundwater directly (i.e., via drinking or bathing in groundwater) or indirectly (such as via inhalation of chemicals volatilizing from groundwater used for irrigation). Since the on-site perched and alluvial groundwater at the Site has not been used as a potable source of water in the past, possible direct contact with COPCs in on-site groundwater was not considered to be a complete exposure pathway for future workers. Furthermore, the more shallow perched zone yields insufficient groundwater to be used as a source of potable water. However, there is no limitation on the off-site use of the alluvial groundwater for potable purposes. It should be noted that several chemicals in off-site alluvial groundwater exceed MCLs or tapwater PRGs (Table 2B). Although arsenic and chromium exceed their respective MCLs, their presence in off-site alluvial groundwater is not related to the Site (AMEC-Geomatrix, 2009). Of the remaining organic chemicals in off-site alluvial groundwater that exceed MCLs and SLs, 1,2-dichloroethane occurs most frequently in off-site groundwater.

Indirect exposure to COPCs in groundwater is dependent on the physical/chemical properties of the chemical and the current and future uses of groundwater. In the case of on-site groundwater, the only potential indirect exposure pathway to a chemical is via volatilization from groundwater, migration of the chemical through soil, and migration into indoor air of an on-site building through seams or cracks in the foundation. This exposure pathway is referred to as the "vapor intrusion pathway." Because the perched groundwater overlies the alluvial groundwater, chemicals present in the alluvial groundwater are unlikely to pose a concern via vapor intrusion in on-site groundwater. Only organic compounds that are sufficiently volatile that are present in perched groundwater may result in exposure via the vapor intrusion pathway. Based on a list of chemicals considered sufficiently volatile to pose a vapor intrusion concern (USEPA, 2002), the following COPCs detected in perched groundwater were selected for the development of RBCs to be protective of the on-site vapor intrusion pathway:

- Acetone
- Aldrin
- 2-Butanone (Methyl ethyl ketone)
- Chlorobenzene
- Chloroform
- 1,2-Dichlorobenzene
- 1,4-Dichlorobenzene
- 1,2-Dichloroethane
- Dieldrin
- Ethylbenzene
- gamma- Hexachlorocyclohexane (Lindane)
- Methoxychlor
- 4-Methyl 2-pentanone (Methyl isobutyl ketone)
- Methylene chloride
- Toluene
- 1,2,4-Trichlorobenzene
- m- and p-Xylenes

RBCs were determined for the vapor intrusion pathway for workers in an on-site building. Although other volatile chemicals were detected in on-site perched groundwater, these chemicals were present in only a single groundwater sample or were detected in fewer than 5% of the samples analyzed (Table 1). These infrequently detected volatile chemicals were not selected as COPCs.

For the off-site alluvial groundwater (Table 2B), the vapor intrusion pathway may be of concern if a residence is located over the affected groundwater. Of the chemicals exceeding MCLs or SLs in off-site alluvial groundwater, only two chemicals were considered sufficiently volatile to result in possible exposure via the vapor intrusion pathway. These chemicals are bis(2-chloroethyl) ether and 1,2-dichloroethane.

Off-site alluvial groundwater may also be used to irrigate crops in fields surrounding the Site. Two possible indirect exposure pathways may result from the use of groundwater for irrigation—uptake of the chemical of potential concern in irrigation water into vegetable produce and inhalation of chemicals volatilizing from the irrigation water. Generally, chemicals considered to volatilize from groundwater (such as 1,2-dichloroethane) would not remain in irrigation water long enough to undergo significant uptake into vegetables. Bis(2-ethylhexyl)phthalate was detected in off-site alluvial groundwater and is not volatile. However, due to metabolism, it does not accumulate in the food chain and is thus unlikely to be significantly taken up into edible produce (ATSDR, 2002).

Given the use of off-site alluvial groundwater for irrigation, volatile chemicals may be released during the growing season when large amounts of groundwater are used to irrigate fields. The USEPA indicates that chemicals with a Henrys law constant greater than 1×10^{-5} atm-m^3/mol and a molecular weight of 200 or lower may be sufficiently volatile to volatilize from water during a shower (USEPA, 1991). Exposure to volatile compounds resulting from use of off-site groundwater for irrigation at the Cedar Chemical Site was addressed by the Agency for Toxic Substances and Disease Registry (ATSDR) in a 2006 report (ATSDR, 2006). The ATSDR determined that at a concentration of 27.1 mg/L in off-site groundwater, 1,2-dichloroethane (1,2-DCA) did not pose a human health concern, stating

> Evaluation of groundwater sampling data and site-specific air dispersion modeling, completed in 2005, revealed levels of 1,2-DCA below its respective health comparison values and poses *No Apparent Public Health Hazard* to exposed individuals. (This category is used for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.)

As a result of the ATSDR conclusion, the irrigation exposure pathway is not further evaluated in this report.

3.2.2 Exposure Pathways to COPCs in Soil

On-site workers may directly contact chemicals of potential concern in soil via incidental ingestion of soil, skin contact with soil, and inhalation of chemicals in soil particles or chemicals that volatilize from soil. In the future, it is possible that industrial workers may be chronically exposed to the COPCs in soil. In addition, construction workers installing utilities or preparing the Site for future use may experience greater soil exposure for a shorter period of time. RBCs for the chemicals of potential concern in soil were determined for the long-term industrial worker and the shorter-term construction worker.

4.0 CALCULATION OF RISK-BASED CONCENTRATIONS

4.1 Groundwater

4.1.1 Risk-based concentrations for vapor intrusion

Two possible vapor intrusion scenarios were considered: 1) on-site commercial industrial land use and; 2) off-site residential land use.

The USEPA's advanced version of the Johnson and Ettinger (J&E) vapor intrusion model for groundwater (GW-ADV; Version 3.1; 02/04) was used to calculate RBCs for volatile chemicals detected in on-site perched groundwater above MCLs or residential SLs. RBCs calculated for volatile COPCs in on-site perched groundwater are presented in Table 5.

For off-site alluvial groundwater, the USEPA's vapor intrusion model was used to calculate RBCs for bis(2-chloroethyl)ether and 1,2-dichloroethane. RBCs for these chemicals in off-site alluvial groundwater are presented in Table 6.

Based on information presented in the Current Conditions report, the site-specific depth to groundwater at the site is assumed to be 17 feet bgs and the soil type was assumed to be silty clay (SIC).

With the exception of the soil/groundwater temperature (commercial/industrial and residential scenarios), building air changes per hour (commercial/industrial scenario only), building dimensions (commercial/industrial scenario only), vapor intrusion model parameters were set to USEPA defaults. Non-default parameters used in the models are presented in the tables below.

On-site Commercial/Industrial Exposure Scenario

Parameter	Value Used	Comment
Soil/Groundwater Temperature	17° C	Specific to Arkansas
Enclosed space floor length	2440 cm	On-site office approximately 80 feet long
Enclosed space floor width	2440 cm	On-site office approximately 80 feet wide
Air changes per hour	1 air change per hr	Cal-EPA, 2005

Off-site Residential Exposure Scenario

Parameter	Value Used	Comment
Soil/Groundwater Temperature	17° C	Specific to Arkansas

For the on-site vapor intrusion exposure pathway, workers were assumed to be exposed 250 days per year for 25 years for 12 hours per day in keeping with the current use of the on-site building at the site. Security guards occupy the on-site building during 12 hour shifts. Because the USEPA vapor intrusion model does not account for exposure for a fraction of a day, the RBC calculated for the on-site worker using the USEPA version of the Johnson and Ettinger vapor intrusion model was divided by 12 hours/24 hours to account for the fact that workers are exposed for 12 hours (rather than 24 hours) per day. An off-site resident was assumed to be exposed 24 hours per day 350 days per year for 30 years.

The RBCs for potential carcinogens are based on a target excess lifetime cancer risk of 1×10^{-5}. RBCs for all other chemicals were based on a hazard quotient of 1 for noncancer effects.

RBCs calculated for the COPCs in on-site perched groundwater for the vapor intrusion pathway are presented in Table 5. Outputs from the USEPA vapor intrusion model are presented in Attachment A.

RBCs for the COPCs in off-site alluvial groundwater are presented in Table 6. Outputs from the USEPA vapor intrusion model are presented in Attachment B.

4.2 Soil

RBCs for 0 to 10 feet bgs soils were developed for each COPC for the on-site industrial worker and construction worker. USEPA default exposure assumptions were used for all exposure assumptions.

The USEPA considers 1,2-dichloroethane to be a volatile organic compound and USEPA procedures for estimating emissions of volatile organic compounds were to estimate 1,2-

dichloroethane emissions from soil. The RBC developed for 1,2-dichloroethane is sensitive to geographic location and size of the area affected. To make this RBC more specific to the Helena-West Helena, area, default EPA inputs for VOC emissions for Little Rock were used. The RBC for 1,2-dichloroethane in on-site soil was calculated for a 40 acre property.

The remaining chemicals are semi-volatile or non-volatile and may be inhaled as particulates from soil. During construction, it was assumed that the airborne dust concentration is 1 mg/m^3 and that the dust is entirely derived from Site soil.

RBCs for the on-site industrial worker and construction worker were based on an excess lifetime cancer risk of 1×10^{-5} for aldrin, chlordane (technical), 1,2 dichloroethane, dieldrin, beta-hexachlorocycolhexane (beta-BHC), gamma-hexachlorocyclohexane (gamma-BHC or lindane), and toxaphene. For dinoseb and propanil, the RBCs are based on a noncancer hazard index of 1.

RBCs for the on-site industrial worker and construction worker are presented in Table 7. Equations and assumptions used for calculation of RBCs for direct contact with soil are presented in Attachment C.

5.0 REFERENCES

AMEC-Geomatrix. 2009 Facility Investigation Report. February 2009

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USEPA. 2007. Region 6 Human Health Medium-Specific Screening Levels, December 4, 2007.

TABLES

Table 1
Summary of On-Site Perched Groundwater Data
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Acetone	34	52	33000	NA	no	5500	YES
Aluminum	30	43	180000	NA	no	37000	YES
Aniline	5	40	160	NA	no	12	YES
Arsenic	40	40	141	10	YES	0.045	YES
Benzene	12	52	2.5	5	no	0.35	YES
Beryllium	24	43	16.5	4	YES	73	no
Butanone, 2- (MEK)	10	53	15000	NA	no	7100	YES
Cadmium	37	43	27.3	5	YES	18	YES
Chloroaniline, 4-	15	43	13000	NA	no	150	YES
Chlorobenzene	22	55	190	100	YES	91	YES
Chloroform	5	53	13000	NA	no	0.17	YES
Chromium	36	43	217	100	YES	NA	no
Dichlorobenzene, 1,2-	47	95	10000	600	YES	49	YES
Dichlorobenzene, 1,4-	26	95	26	75	no	0.47	YES
Dichloroethane, 1,2-	37	52	730000	5	YES	0.12	YES
Dieldrin	5	43	1.8	NA	no	0.0042	YES
Dinoseb	35	87	22000	7	YES	37	YES
Dioxane, 1,4-	7	7	25	NA	no	6.1	YES
Ethylbenzene	13	52	51000	700	YES	1300	YES
Hexachlorocyclohexane, alpha-	11	43	2.5	NA	no	0.011	YES
Hexachlorocyclohexane, beta-	7	43	0.96	NA	no	0.037	YES
Hexachlorocyclohexane, gamma-	7	43	110	0.2	YES	0.052	YES
Iron	50	57	239000	NA	no	26000	YES
Lead	42	43	201	15	YES	NA	no
Manganese	57	57	208000	NA	no	1700	YES
Methoxychlor	7	45	72	40	YES	180	no
Methyl-2-pentanone, 4- (MIBK)	9	54	10000	NA	no	7100	YES
Methylene chloride	14	54	26000	5	YES	4.3	YES
Methylphenol & 4-Methylphenol, 3-	5	43	650	NA	no	180	YES
Nickel	43	43	799	NA	no	730	YES
Propanil	15	43	18000	NA	no	180	YES
Selenium	34	43	150	50	YES	180	no
Thallium	23	43	4.1	2	YES	2.6	YES
Toluene	20	55	210000	1000	YES	2300	YES
Vanadium	42	43	486	NA	no	180	YES
Xylene, m- & p-	8	53	220000	NA	no	210	YES
Xylenes (total)	5	52	790	10000	no	200	YES
Chlordane, gamma-	4	40	0.96	2	no	0.19	YES
Nitrophenol, 4-	4	43	3000	NA	no	290	YES
Trichlorobenzene, 1,2,4-	4	43	30	70	no	8.2	YES
bis(2-Ethylhexyl) phthalate	3	47	23	6	YES	4.8	YES
Heptachlor epoxide	3	43	1.2	0.2	YES	0.0074	YES
Aldrin	3	43	0.11	NA	no	0.004	YES
DDD, 4,4'-	3	43	0.94	NA	no	0.28	YES
Dinitrophenol, 2,4-	3	40	16000	NA	no	73	YES

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

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Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Fluoride	3	3	3550	NA	no	2200	YES
Isophorone	3	43	9100	NA	no	71	YES
Heptachlor	2	43	1.3	0.1	YES	0.015	YES
Dichloropropane, 1,2-	1	52	20	5	YES	0.16	YES
Styrene	1	52	2200	100	YES	1600	YES
Acetaldehyde	1	1	3200	NA	no	1.7	YES
Acetonitrile	1	1	1700	NA	no	120	YES
Carbon tetrachloride	1	49	1.6	5	no	0.17	YES
Nitrobenzene	1	43	7.9	NA	no	3.4	YES
Trichloroethane, 1,1,2-	1	52	1.5	5	no	0.2	YES
Trimethylbenzene, 1,3,5-	1	1	51000	NA	no	12	YES
Vinyl chloride	1	52	1.1	2	no	0.015	YES
Acetamide, N-(3-chlorophenyl)-	3	3	13	NA	no	NA	no
Acetamide, N-methyl-N-(trimeth	1	1	130	NA	no	NA	no
Acetophenone	2	2	8.9	NA	no	610	no
Antimony	36	40	2.5	6	no	15	no
Azabicyclo[3.1.0]hexane-2,4-, 3-	1	1	10	NA	no	NA	no
Barium	43	43	623	2000	no	7300	no
Benzaldehyde	1	1	190	NA	no	3700	no
Benzenamine, 2,3-dichloro-	1	1	2300	NA	no	NA	no
Benzenamine, 2,4,5-trichloro-	1	1	12	NA	no	NA	no
Benzenamine, 2,5-dichloro-	11	11	4800	NA	no	NA	no
Benzenamine, 2,6-dichloro-	6	6	4700	NA	no	NA	no
Benzenamine, 3,5-dichloro-	1	1	21	NA	no	NA	no
Benzenamine, 4-chloro-N-methyl	2	2	8.2	NA	no	NA	no
Benzenamine, N-ethyl-3-methyl-	1	1	55	NA	no	NA	no
Benzene, (1-methylethyl)-	4	4	10	NA	no	NA	no
Benzene, 1-(1,1-dimethylethyl)	1	1	16	NA	no	NA	no
Benzene, 1,2,3,5-tetramethyl-	3	3	4.7	NA	no	NA	no
Benzene, 1,2-diethyl-	2	2	5.8	NA	no	NA	no
Benzene, 1,3-diethyl-	6	6	59	NA	no	NA	no
Benzene, 1,4-dichloro-2-nitro-	1	1	420	NA	no	NA	no
Benzene, 1,4-diethyl-	6	6	57	NA	no	NA	no
Benzene, 1-chloro-4-(methylsul	1	1	1.7	NA	no	NA	no
Benzene, 1-chloro-4-isocyanato	1	1	21	NA	no	NA	no
Benzene, 1-ethyl-2,4-dimethyl-	2	2	4	NA	no	NA	no
Benzene, 1-ethyl-2-methyl-	3	3	6.4	NA	no	NA	no
Benzene, 1-ethyl-4-methyl-	1	1	190000	NA	no	NA	no
Benzene, 1-methyl-2-(1-methylethyl)-	2	2	6.6	NA	no	NA	no
Benzene, 1-methyl-4-(1-methylethyl)-	1	1	3	NA	no	NA	no
Benzene, 2-ethenyl-1,4-dimethyl-	2	2	1.8	NA	no	NA	no
Benzene, 2-ethyl-1,3-dimethyl-	1	1	3	NA	no	NA	no
Benzene, 4-ethyl-1,2-dimethyl-	2	2	2.2	NA	no	NA	no
Benzene, methoxy-	3	3	610	NA	no	NA	no
Benzene, propyl-	3	3	41	NA	no	61	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 1
Summary of On-Site Perched Groundwater Data
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Benzeneacetamide, N,N-dimethyl	3	3	2.1	NA	no	NA	no
Benzeneacetic acid	1	1	1.5	NA	no	NA	no
Benzeneacetic acid, .alpha.-hy	1	1	86	NA	no	NA	no
Benzenepropanal	2	2	2.7	NA	no	NA	no
Benzoic acid	6	43	1100	NA	no	150000	no
Benzoic acid, 2-amino-5-chloro	1	1	37	NA	no	NA	no
Benzoic acid, 2-amino-6-chloro	2	2	150	NA	no	NA	no
Benzoic acid, 2-chloro-6-nitro	1	1	300	NA	no	NA	no
Benzoic acid, 3,5-dichloro-, m	1	1	280	NA	no	NA	no
Benzoic acid, 3-chloro-	2	2	5000	NA	no	NA	no
Benzoic acid, 3-chloro-4-hydro	1	1	2.4	NA	no	NA	no
Benzoic acid, 3-methyl-, methy	2	2	990	NA	no	NA	no
Benzoic acid, 4-chloro-	2	2	2900	NA	no	NA	no
Benzoic acid, 4-chloro-, methy	2	2	2000	NA	no	NA	no
Benzoic acid, 4-chloro-2-nitro	1	1	130	NA	no	NA	no
Benzoic acid, 4-chloro-2-nitro1	1	1	5700	NA	no	NA	no
Benzoic acid, 4-chloro-2-nitro2	1	1	550	NA	no	NA	no
Benzoic acid, 4-chloro-3-nitro1	1	1	350	NA	no	NA	no
Benzoic acid, 4-chloro-3-nitro2	1	1	17	NA	no	NA	no
Benzoic acid, 4-methyl-	2	2	690	NA	no	NA	no
Benzothiazolone, 2(3H)-	1	1	2.6	NA	no	NA	no
Benzyl alcohol	2	43	86	NA	no	11000	no
Bicyclo[2.1.0]pentane	1	1	5.7	NA	no	NA	no
Bromacil	2	2	100	NA	no	NA	no
Butanal, 3-hydroxy-	1	1	1.6	NA	no	NA	no
Butanenitrile, 2-methyl-	3	3	1000	NA	no	NA	no
Butanoic acid, 2-methyl-	2	2	970	NA	no	NA	no
Butanoic acid, 3-methyl-	1	1	4.3	NA	no	NA	no
Butyl benzyl phthalate	1	43	15	NA	no	7300	no
Butylacetamide, N-tert-	2	2	7.7	NA	no	NA	no
Carbon disulfide	2	49	1.9	NA	no	1000	no
Chlordane, alpha-	4	40	0.11	2	no	0.19	no
Chloro-4-nitrobenzhydrazide, 2-	1	1	280	NA	no	NA	no
Chloro-4-nitrobenzoic acid, 3-	1	1	23	NA	no	NA	no
Chloroaniline hydrochloride, o-	7	7	600	NA	no	NA	no
Chlorobenzoic acid hydrazide, 4-	1	1	27	NA	no	NA	no
Chloro-beznofurazan oxide, 5-	1	1	710	NA	no	NA	no
Chloroiodomethane	3	3	12	NA	no	NA	no
Chloromethane	5	52	0.96	NA	no	190	no
Chlorophenol, 2-	3	43	12	NA	no	30	no
Chromium, hexavalent (dissolved)	10	12	8	100	no	110	no
Cobalt	43	43	439	NA	no	730	no
Copper	43	43	498	1300	no	1400	no
Cyanide, Total	2	3	0.27	200	no	730	no
Cyclohexadiene-1,2-dion, 3,5-	1	1	6.5	NA	no	NA	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 1
Summary of On-Site Perched Groundwater Data
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Cyclohexasiloxane, dodecamethy	2	2	2.5	NA	no	NA	no
Cyclopropanecarboxylic acid, 3	1	1	1600	NA	no	NA	no
Cyclotetrasiloxane, octamethyl-	1	1	64	NA	no	NA	no
Cyclotrisiloxane, hexamethyl-	1	1	2.2	NA	no	NA	no
DDE, 4,4'-	2	43	0.026	NA	no	0.2	no
DDT, 4,4'-	1	43	0.015	NA	no	0.2	no
Dibromofluoromethane	58	58	1700000	NA	no	NA	no
Dichloroaniline, 3,4-	21	43	62000	NA	no	NA	no
Dichlorobenzamide, 3,4-	1	1	6.4	NA	no	NA	no
Dichlorobenzene, 1,3-	3	95	3.1	NA	no	14	no
Dichlorobenzoic acid, 3,5-	2	2	2100	NA	no	NA	no
Dichloroethene, 1,2- (total)	1	52	0.74	NA	no	NA	no
Dichloroethene, cis-1,2-	3	52	0.53	70	no	61	no
Dichlorophenol, 2,4-	7	43	60	100	no	110	no
Dichlorophenol, 2,6-	1	1	1	NA	no	NA	no
Diethyl phthalate	4	43	7.8	NA	no	29000	no
Diethyltoluamide	3	3	15	NA	no	NA	no
Dimethoxy-b-methyl-b-n, cis-3,5-	1	1	190	NA	no	NA	no
Dimethyl trisulfide	1	1	92	NA	no	NA	no
Dimethyl-o-phenylenediamin, 3,4-	1	1	56	NA	no	NA	no
Dimethyl-ortho-phenylenedi, 4,5-	1	1	190	NA	no	NA	no
Dimethylphenol, 2,4-	3	40	8.9	NA	no	730	no
Dinoseb triethylamine salt	1	1	1000	NA	no	NA	no
Dioxolane, 2-ethyl-4-methy, 1,3-	2	2	9.4	NA	no	NA	no
Diphenyl-2-hydroxyacetic a, 2,2-	1	1	7.8	NA	no	NA	no
Diphthalimido-2-propanol, 1,3-	1	1	7.7	NA	no	NA	no
Disulfide, dimethyl	3	3	440	NA	no	NA	no
Endosulfan I	1	43	1.1	NA	no	220	no
Endosulfan II	4	43	0.59	NA	no	220	no
Endosulfan sulfate	1	43	0.042	NA	no	220	no
Endrin	6	43	0.12	2	no	11	no
Endrin aldehyde	3	43	0.95	NA	no	NA	no
Endrin ketone	3	43	0.15	NA	no	NA	no
Erucylamide	5	5	12	NA	no	NA	no
Ethane	3	16	51	NA	no	NA	no
Ethane, isothiocyanato-	2	2	39	NA	no	NA	no
Ethanone, 1-(2,4-dimethylphenyl)-	1	1	1.8	NA	no	NA	no
Ethanone, 2-hydroxy-1,2-bis	1	1	110	NA	no	NA	no
Ethenamine, n-methylene-	2	2	4300	NA	no	NA	no
Ethene	4	16	150	NA	no	NA	no
Formamide, N-(3,4-dichlorophen	1	1	7.5	NA	no	NA	no
Furandione, dihydro-, 2,5-	1	1	5.8	NA	no	NA	no
Furanone, 3,5,5-trimethy, 2(5H)-	1	1	54	NA	no	NA	no
Hexachlorocyclohexane, delta-	9	43	1.3	NA	no	NA	no
Hexadecanoic acid, n-	2	2	2	NA	no	NA	no

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Hexanedioic acid, dimethyl est	1	1	0.6	NA	no	NA	no
Hexanoic acid, 2-methyl-	1	1	3700	NA	no	NA	no
Hexanone, 2-	2	52	16	NA	no	NA	no
Hexyne, 2-	2	2	770	NA	no	NA	no
Hydrastindiol	1	1	5	NA	no	NA	no
Hydroxy-3,5-diethyl-5-methyl, 2-	1	1	100	NA	no	NA	no
Hydroxy-3-methyl-2-butanone, 3-	1	1	0.69	NA	no	NA	no
indole, 5-methyl-2-phenyl-, 1H-	1	1	4.7	NA	no	NA	no
Isosafrole (cis & trans)	2	2	0.043	NA	no	NA	no
Mercury	11	16	1.3	2	no	11	no
Methane	15	16	13000	NA	no	NA	no
Methane, dichlorofluoro-	1	1	7	NA	no	NA	no
Methanone, (2-hydroxyphenyl)(4	1	1	3.8	NA	no	NA	no
Methoxy-4-nitro-2,3,5,6-tetr, 1-	1	1	68	NA	no	NA	no
Methoxybenzhydrazide, 4-	1	1	120	NA	no	NA	no
Methylnaphthalene, 1-	2	2	5.1	NA	no	NA	no
Methylphenol, 2-	4	43	730	NA	no	NA	no
Molinate	1	1	2.6	NA	no	NA	no
Morpholine, 4-propionyl-	1	1	3500	NA	no	NA	no
N-(2-Hydroxyethyl)-N-methylani	1	1	7.5	NA	no	NA	no
N,N-Dimethylformamide	2	2	24	NA	no	NA	no
Naphthalene	1	43	1.5	NA	no	6.2	no
Naphthylamine, 1-	1	1	2.9	NA	no	NA	no
Nitrate as N	8	27	1190	10000	no	10000	no
Nitrogen, as Ammonia	9	15	4790	NA	no	NA	no
Nitrophenol, 2-	2	43	120	NA	no	NA	no
Nitrophenyl)-5-phenyl[1,3, 2-(4-	1	1	25	NA	no	NA	no
Noruron	4	4	64	NA	no	NA	no
Octadecenamide, (Z)-, 9-	2	2	11	NA	no	NA	no
Pentanamide, N-(3,4-dichloroph	1	1	13	NA	no	NA	no
Pentanone, 3-methyl-, 2-	1	1	260	NA	no	NA	no
Pentanone, 4-hydroxy-4-methy, 2-	4	4	600	NA	no	NA	no
Penten-2-one, 4-methyl-, 3-	1	1	150	NA	no	NA	no
Pentene, 2,3-dimethyl-, 2-	1	1	120	NA	no	NA	no
Permetrinic acid, methyl ester	1	1	150	NA	no	NA	no
Phenol	5	43	220	NA	no	11000	no
Phenol, (1,1,3,3-tetramethylbu	2	2	13	NA	no	NA	no
Phenol, 2-(1-methylpropyl)-	2	2	6300	NA	no	NA	no
Phenol, 2-chloro-4,6-dinitro-	1	1	17	NA	no	NA	no
Phenol, 3-(1-methylethyl)-	1	1	5000	NA	no	NA	no
Phenol, 3,4-dichloro-	4	4	360	NA	no	NA	no
Phenol, 3,5-dichloro-	2	2	200	NA	no	NA	no
Phenoxybenzoic acid, m-	1	1	940	NA	no	NA	no
Phthalic anhydride	1	1	1	NA	no	73000	no
Pronamide	1	1	150	NA	no	NA	no

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Propane, 2-ethoxy-2-methyl-	1	1	4.1	NA	no	NA	no
Propanoic acid, 2,2-dimethyl-	1	1	190	NA	no	NA	no
Propanoic acid, 2-methyl-	1	1	3.8	NA	no	NA	no
Propylbenzene, n-	2	2	33	NA	no	61	no
Propylbiphenyl-4'-carboxylic, 4-	1	1	9.4	NA	no	NA	no
Pyrazol-3-one, 2,4-dihydro-, 3H-	1	1	4.6	NA	no	NA	no
Pyrazole, 4,5-dihydro-5,5-d, 1H-	1	1	6200	NA	no	NA	no
Pyrrolidinedione, 1-methyl, 2,5-	1	1	2.9	NA	no	NA	no
Pyrrolo[1,2-a]-1,3,5-triazine-	1	1	1.6	NA	no	NA	no
Silver	6	44	0.98	NA	no	180	no
Spiro[9H-fluorene-9,3'(2'H)-[1	1	1	12	NA	no	NA	no
Squalene	1	1	5.9	NA	no	NA	no
Tebuthiuron	1	1	6.1	NA	no	NA	no
Tetracyclo[7.3.1.0(2,7).1(7,11	1	1	9.3	NA	no	NA	no
Thiazole, 5-methyl-	1	1	43	NA	no	NA	no
Thiocyanic acid, ethyl ester	1	1	24	NA	no	NA	no
Toluidine, o-	1	1	15	NA	no	NA	no
Tribromophenol, 2,4,6-	50	67	93	NA	no	NA	no
Tricyclo[4.2.2.0(1,5)]decane	1	1	3.3	NA	no	NA	no
Trimethylbenzene, 1,2,4-	2	2	6.5	NA	no	13	no
Undecane, 5-methyl-	1	1	0.82	NA	no	NA	no
Urea, N,N'-dimethyl-	1	1	11	NA	no	NA	no
Vinyl acetate	1	52	35	NA	no	410	no
Vinyl-4,5-dihydro-3H-pyrazol, 4-	1	1	800	NA	no	NA	no
Xylene, o-	8	52	72000	NA	no	73000	no
Zinc	43	43	1170	NA	no	11000	no
Acenaphthene	0	43	0	ND	ND	ND	ND
Acenaphthylene	0	43	0	ND	ND	ND	ND
Anthracene	0	40	0	ND	ND	ND	ND
Benzo(a)anthracene	0	43	0	ND	ND	ND	ND
Benzo(a)pyrene	0	43	0	ND	ND	ND	ND
Benzo(b)fluoranthene	0	43	0	ND	ND	ND	ND
Benzo(ghi)perylene	0	43	0	ND	ND	ND	ND
Benzo(k)fluoranthene	0	43	0	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	0	47	0	ND	ND	ND	ND
bis(2-Chloroethyl) ether	0	47	0	ND	ND	ND	ND
bis(2-Chloroisopropyl) ether	0	47	0	ND	ND	ND	ND
Bromobenzene	0	52	0	ND	ND	ND	ND
Bromochloromethane	0	52	0	ND	ND	ND	ND
Bromodichloromethane	0	52	0	ND	ND	ND	ND
Bromoform	0	52	0	ND	ND	ND	ND
Bromomethane	0	52	0	ND	ND	ND	ND
Bromophenyl phenyl ether, 4-	0	43	0	ND	ND	ND	ND
Chlordane (technical)	0	40	0	ND	ND	ND	ND
Chloro-3-methylphenol, 4-	0	40	0	ND	ND	ND	ND

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Chloroethane	0	52	0	ND	ND	ND	ND
Chloroethyl vinyl ether, 2-	0	52	0	ND	ND	ND	ND
Chloronaphthalene, 2-	0	43	0	ND	ND	ND	ND
Chlorophenyl phenyl ether, 4-	0	43	0	ND	ND	ND	ND
Chrysene	0	43	0	ND	ND	ND	ND
Dibenz(a,h)anthracene	0	43	0	ND	ND	ND	ND
Dibenzofuran	0	43	0	ND	ND	ND	ND
Dibromochloromethane	0	52	0	ND	ND	ND	ND
Dibromoethane, 1,2- (EDB)	0	51	0	ND	ND	ND	ND
Dibromomethane	0	52	0	ND	ND	ND	ND
Dichlorobenzidine, 3,3'-	0	43	0	ND	ND	ND	ND
Dichloroethane, 1,1-	0	52	0	ND	ND	ND	ND
Dichloroethene, 1,1-	0	52	0	ND	ND	ND	ND
Dichloroethene, trans-1,2-	0	52	0	ND	ND	ND	ND
Dichloropropene, cis-1,3-	0	52	0	ND	ND	ND	ND
Dichloropropene, trans-1,3-	0	52	0	ND	ND	ND	ND
Dimethyl phthalate	0	43	0	ND	ND	ND	ND
Di-n-butyl phthalate	0	40	0	ND	ND	ND	ND
Dinitro-2-methylphenol, 4,6-	0	40	0	ND	ND	ND	ND
Dinitrotoluene, 2,4-	0	40	0	ND	ND	ND	ND
Dinitrotoluene, 2,6-	0	40	0	ND	ND	ND	ND
Di-n-octyl phthalate	0	40	0	ND	ND	ND	ND
Fluoranthene	0	43	0	ND	ND	ND	ND
Fluorene	0	43	0	ND	ND	ND	ND
Hexachlorobenzene	0	43	0	ND	ND	ND	ND
Hexachlorobutadiene	0	43	0	ND	ND	ND	ND
Hexachlorocyclopentadiene	0	43	0	ND	ND	ND	ND
Hexachloroethane	0	43	0	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0	43	0	ND	ND	ND	ND
Methylnaphthalene, 2-	0	43	0	ND	ND	ND	ND
Nitroaniline, 2-	0	43	0	ND	ND	ND	ND
Nitroaniline, 3-	0	43	0	ND	ND	ND	ND
Nitroaniline, 4-	0	43	0	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	0	43	0	ND	ND	ND	ND
N-Nitrosodiphenylamine	0	43	0	ND	ND	ND	ND
Pentachlorophenol	0	43	0	ND	ND	ND	ND
Phenanthrene	0	43	0	ND	ND	ND	ND
Pyrene	0	42	0	ND	ND	ND	ND
Tetrachloroethane, 1,1,2,2-	0	51	0	ND	ND	ND	ND
Tetrachloroethene	0	51	0	ND	ND	ND	ND
Toxaphene	0	43	0	ND	ND	ND	ND
Trichloroethane, 1,1,1-	0	52	0	ND	ND	ND	ND
Trichloroethene	0	52	0	ND	ND	ND	ND
Trichlorofluoromethane	0	52	0	ND	ND	ND	ND
Trichlorophenol, 2,4,5-	0	43	0	ND	ND	ND	ND

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Trichlorophenol, 2,4,6-	0	43	0	ND	ND	ND	ND

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Table 2A
Summary of On-Site Alluvial Groundwater Data (September and November 2008 Sampling Rounds)
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Arsenic	29	29	152	10	YES	0.045	YES
Benzene	5	29	21	5	YES	0.35	YES
bis(2-Chloroethyl) ether	5	29	41	NA	no	0.0098	YES
Chloroaniline, 4-	9	29	3000	NA	no	150	YES
Chlorobenzene	11	33	310	100	YES	91	YES
Dichlorobenzene, 1,2-	16	58	1100	600	YES	49	YES
Dichlorobenzene, 1,4-	5	58	11	75	no	0.47	YES
Dichloroethane, 1,2-	15	29	4900	5	YES	0.12	YES
Dinoseb	13	58	27	7	YES	37	no
Hexachlorocyclohexane, gamma (g-BHC)	7	29	0.059	0.2	no	0.052	YES
Aldrin	4	29	0.053	NA	no	0.004	YES
Chloroethane	4	29	11	5	YES	4.3	YES
Aniline	3	29	18	NA	no	12	YES
Dichlorobenzene, 1,3-	2	58	90	NA	no	14	YES
Heptachlor	2	29	0.076	0.1	no	0.015	YES
Hexachlorocyclohexane, beta (b-BHC)	2	29	0.046	NA	no	0.037	YES
Vinyl chloride	2	29	10	2	YES	0.015	YES
Chloroform	1	29	0.43	NA	no	0.17	YES
Dichloropropane, 1,2-	1	29	2.1	5	no	0.16	YES
Heptachlor epoxide	1	29	0.098	0.2	no	0.0074	YES
Trichloroethane, 1,1,2-	1	29	0.53	5	no	0.2	YES
Acenaphthene	0	29	ND	NA	no	370	no
Acenaphthylene	0	29	ND	NA	no	NA	no
Acetone	22	29	48	NA	no	5500	no
Anthracene	0	29	ND	NA	no	1800	no
Barium	29	29	958	2000	no	7300	no
Benzo(a)anthracene	0	29	ND	NA	no	0.029	no
Benzo(a)pyrene	0	29	ND	0.2	no	0.0029	no
Benzo(b)fluoranthene	0	29	ND	NA	no	0.029	no
Benzo(ghi)perylene	0	29	ND	NA	no	NA	no
Benzo(k)fluoranthene	0	29	ND	NA	no	0.29	no
Benzoic acid	0	29	ND	NA	no	150000	no
Benzyl alcohol	0	29	ND	NA	no	11000	no
bis(2-Chloroethoxy)methane	0	29	ND	NA	no	NA	no
bis(2-Chloroisopropyl) ether	0	29	ND	NA	no	NA	no
bis(2-Ethylhexyl) phthalate	1	29	2.7	6	no	4.8	no
Bromobenzene	0	29	ND	NA	no	23	no
Bromochloromethane	0	29	ND	NA	no	NA	no
Bromodichloromethane	0	29	ND	NA	no	0.18	no
Bromofluorobenzene, 4-	34	34	1700	NA	no	NA	no
Bromoform	0	29	ND	NA	no	8.5	no
Bromomethane	0	29	ND	NA	no	8.7	no
Bromophenyl phenyl ether, 4-	0	29	ND	NA	no	NA	no
Butanone, 2- (MEK)	1	29	1.4	NA	no	7100	no

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Butyl benzyl phthalate	0	29	ND	NA	no	7300	no
Carbaryl	1	1	10	NA	no	3700	no
Carbon disulfide	0	29	ND	NA	no	1000	no
Carbon tetrachloride	0	29	ND	5	no	0.17	no
Chlordane (technical)	0	29	ND	2	no	0.19	no
Chlordane, alpha-	1	29	0.0098	2	no	0.19	no
Chlordane, gamma	0	29	ND	2	no	0.19	no
Chloro-3-methylphenol, 4-	0	29	ND	NA	no	NA	no
Chloroaniline, o- (hydrochloride)	5	5	80	NA	no	NA	no
Chloroethyl vinyl ether, 2-	0	29	ND	NA	no	NA	no
Chloromethane	2	29	1.7	NA	no	190	no
Chloronaphthalene, 2-	0	29	ND	NA	no	490	no
Chlorophenol, 2-	1	29	3.6	NA	no	30	no
Chlorophenyl phenyl ether, 4-	0	29	ND	NA	no	NA	no
Chromium	26	29	29.7	100	no	NA	no
Chrysene	0	29	ND	NA	no	2.9	no
DDD, 4,4'-	1	29	0.041	NA	no	0.28	no
DDE, 4,4'-	0	29	ND	NA	no	0.2	no
DDT, 4,4'-	0	29	ND	NA	no	0.2	no
Decachlorobiphenyl	27	29	0.21	NA	no	NA	no
Dibenz(a,h)anthracene	0	29	ND	NA	no	0.0029	no
Dibenzofuran	0	29	ND	NA	no	12	no
Dibromochloromethane	0	29	ND	NA	no	0.13	no
Dibromoethane, 1,2- (EDB)	0	29	ND	NA	no	0.0026	no
Dibromofluoromethane	34	34	1800	NA	no	NA	no
Dibromomethane	0	29	ND	NA	no	NA	no
Dichloroaniline, 3,4-	13	29	17000	NA	no	NA	no
Dichlorobenzidine, 3,3'-	0	29	ND	NA	no	0.15	no
Dichloroethane, 1,1-	0	29	ND	NA	no	1200	no
Dichloroethene, 1,1-	2	29	1.3	7	no	340	no
Dichloroethene, 1,2- (total)	0	29	ND	70	no	61	no
Dichloroethene, cis-1,2-	0	29	ND	70	no	61	no
Dichloroethene, trans-1,2-	0	29	ND	100	no	110	no
Dichlorophenol, 2,4-	2	29	39	NA	no	110	no
Dichloropropene, cis-1,3-	0	29	ND	NA	no	0.4	no
Dichloropropene, trans-1,3-	0	29	ND	NA	no	0.4	no
Dieldrin	0	29	ND	NA	no	0.0042	no
Diethyl phthalate	1	29	1.5	NA	no	29000	no
Dimethyl phthalate	0	29	ND	NA	no	370000	no
Dimethylphenol, 2,4-	0	29	ND	NA	no	730	no
Di-n-butyl phthalate	3	29	1.8	NA	no	3700	no
Dinitro-2-methylphenol, 4,6-	0	29	ND	NA	no	NA	no
Dinitrophenol, 2,4-	0	29	ND	NA	no	73	no
Dinitrotoluene, 2,4-	0	57	ND	NA	no	73	no

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Di-n-octyl phthalate	0	29	ND	NA	no	NA	no
Dioxane, 1,4-	5	5	4.2	NA	no	6.1	no
Endosulfan I	0	29	ND	NA	no	220	no
Endosulfan II	1	29	0.0069	NA	no	220	no
Endosulfan sulfate	0	29	ND	NA	no	220	no
Endrin	1	29	0.0081	2	no	11	no
Endrin aldehyde	0	29	ND	NA	no	NA	no
Endrin ketone	1	29	0.0074	NA	no	NA	no
Erucylamide	13	13	19	NA	no	NA	no
Ethylbenzene	2	29	9.2	700	no	1300	no
Fluoranthene	0	29	ND	NA	no	1500	no
Fluorene	0	29	ND	NA	no	240	no
Fluorobiphenyl, 2-	32	33	48	NA	no	NA	no
Fluorophenol, 2-	32	33	74	NA	no	NA	no
Hexachlorobenzene	0	29	ND	1	no	0.042	no
Hexachlorobutadiene	0	29	ND	NA	no	0.86	no
Hexachlorocyclohexane, alpha (a-BHC)	3	29	0.01	NA	no	0.011	no
Hexachlorocyclohexane, delta (d-BHC)	3	29	0.05	NA	no	NA	no
Hexachlorocyclopentadiene	0	29	ND	50	no	220	no
Hexachloroethane	0	29	ND	NA	no	4.8	no
Hexanone, 2-	10	32	44	NA	no	NA	no
Indeno(1,2,3-cd)pyrene	0	29	ND	NA	no	0.029	no
Isophorone	1	29	1.3	NA	no	71	no
Methoxychlor	2	29	0.07	40	no	180	no
Methyl-2-pentanone, 4- (MIBK)	2	29	1.2	NA	no	2000	no
Methylene chloride	1	29	0.8	5	no	4.3	no
Methylnaphthalene, 2-	0	29	ND	NA	no	NA	no
Methyl-N-methylcarbamate, O-	9	9	89	NA	no	NA	no
Methylphenol, 2-	1	29	41	NA	no	NA	no
Methylphenol, 3- & Methylphenol, 4-	1	29	3.5	NA	no	180	no
Naphthalene	0	29	ND	NA	no	6.2	no
Nickel	29	29	148	NA	no	730	no
Nitroaniline, 2-	0	29	ND	NA	no	110	no
Nitroaniline, 3-	0	29	ND	NA	no	NA	no
Nitroaniline, 4-	0	29	ND	NA	no	NA	no
Nitrobenzene	0	29	ND	NA	no	3.4	no
Nitrophenol, 2-	0	29	ND	NA	no	NA	no
Nitrophenol, 4-	0	29	ND	NA	no	290	no
N-Nitrosodi-n-propylamine	0	29	ND	NA	no	0.0096	no
N-Nitrosodiphenylamine	0	29	ND	NA	no	14	no
Noruron	2	2	0.93	NA	no	NA	no
Pentachlorophenol	0	29	ND	1	no	0.56	no
Phenanthrene	0	29	ND	NA	no	NA	no
Phenol	1	29	5.4	NA	no	11000	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 2A
Summary of On-Site Alluvial Groundwater Data (September and November 2008 Sampling Rounds)
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Propanil	1	29	49	NA	no	180	no
Propene	7	7	8.2	NA	no	NA	no
Pyrene	0	29	ND	NA	no	180	no
Styrene	0	29	ND	100	no	1600	no
Tetrachloroethane, 1,1,2,2-	0	29	ND	NA	no	0.055	no
Tetrachloroethene	0	29	ND	5	no	0.1	no
Toluene	2	29	0.71	1000	no	2300	no
Toxaphene	0	29	ND	3	no	0.061	no
Trichlorobenzene, 1,2,4-	2	29	5.7	70	no	8.2	no
Trichloroethane, 1,1,1-	0	29	ND	200	no	73000	no
Trichloroethene	0	29	ND	5	no	0.028	no
Trichlorofluoromethane	0	29	ND	NA	no	1300	no
Trichlorophenol, 2,4,5-	0	29	ND	NA	no	3700	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 2B
Summary of Off-Site Alluvial Groundwater Data (September and November 2008 Sampling Rounds)
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Arsenic	23	23	7.6	10	no	0.045	YES
bis(2-Ethylhexyl) phthalate	5	23	300	6	YES	4.8	YES
Chromium	14	23	145	100	YES	NA	no
Dichloroethane, 1,2-	13	23	19000	5	YES	0.12	YES
Benzene	1	23	0.8	5	no	0.35	YES
bis(2-Chloroethyl) ether	2	23	4.6	NA	no	0.0098	YES
Chloroform	1	23	0.5	NA	no	0.17	YES
Acenaphthene	0	23	ND	NA	no	370	no
Acenaphthylene	0	23	ND	NA	no	NA	no
Acetone	8	23	9.3	NA	no	5500	no
Aldrin	0	23	ND	NA	no	0.004	no
Aniline	1	23	2.2	NA	no	12	no
Anthracene	0	23	ND	NA	no	1800	no
Barium	23	23	526	2000	no	7300	no
Benzo(a)anthracene	0	23	ND	NA	no	0.029	no
Benzo(a)pyrene	0	23	ND	0.2	no	0.0029	no
Benzo(b)fluoranthene	0	23	ND	NA	no	0.029	no
Benzo(ghi)perylene	0	23	ND	NA	no	NA	no
Benzo(k)fluoranthene	0	23	ND	NA	no	0.29	no
Benzoic acid	0	23	ND	NA	no	150000	no
Benzyl alcohol	0	23	ND	NA	no	11000	no
bis(2-Chloroethoxy)methane	0	23	ND	NA	no	NA	no
bis(2-Chloroisopropyl) ether	0	23	ND	NA	no	NA	no
Bromobenzene	0	23	ND	NA	no	23	no
Bromochloromethane	0	23	ND	NA	no	NA	no
Bromodichloromethane	0	23	ND	NA	no	0.18	no
Bromofluorobenzene, 4-	24	24	4000	NA	no	NA	no
Bromoform	0	23	ND	NA	no	8.5	no
Bromomethane	0	23	ND	NA	no	8.7	no
Bromophenyl phenyl ether, 4-	0	23	ND	NA	no	NA	no
Butanone, 2- (MEK)	3	23	3.7	NA	no	7100	no
Butyl benzyl phthalate	0	23	ND	NA	no	7300	no
Carbon disulfide	2	23	1.1	NA	no	1000	no
Carbon tetrachloride	0	23	ND	5	no	0.17	no
Chlordane (technical)	0	23	ND	2	no	0.19	no
Chlordane, alpha-	0	23	ND	2	no	0.19	no
Chlordane, gamma	0	23	ND	2	no	0.19	no
Chloro-3-methylphenol, 4-	0	23	ND	NA	no	NA	no
Chloroaniline, 4-	0	23	ND	NA	no	150	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 2B
Summary of Off-Site Alluvial Groundwater Data (September and November 2008 Sampling Rounds)
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Chlorobenzene	1	23	0.81	100	no	91	no
Chloroethane	0	23	ND	5	no	4.3	no
Chloroethyl vinyl ether, 2-	0	23	ND	NA	no	NA	no
Chloromethane	0	23	ND	NA	no	190	no
Chloronaphthalene, 2-	0	23	ND	NA	no	490	no
Chlorophenol, 2-	0	23	ND	NA	no	30	no
Chlorophenyl phenyl ether, 4-	0	23	ND	NA	no	NA	no
Chrysene	0	23	ND	NA	no	2.9	no
DDD, 4,4'-	0	23	ND	NA	no	0.28	no
DDE, 4,4'-	0	23	ND	NA	no	0.2	no
DDT, 4,4'-	0	23	ND	NA	no	0.2	no
Decachlorobiphenyl	23	34	0.16	NA	no	NA	no
Dibenz(a,h)anthracene	0	23	ND	NA	no	0.0029	no
Dibenzofuran	0	23	ND	NA	no	12	no
Dibromochloromethane	0	23	ND	NA	no	0.13	no
Dibromoethane, 1,2- (EDB)	0	23	ND	NA	no	0.0026	no
Dibromofluoromethane	31	31	4700	NA	no	NA	no
Dibromomethane	0	23	ND	NA	no	NA	no
Dichloroaniline, 3,4-	0	23	ND	NA	no	NA	no
Dichlorobenzene, 1,2-	0	46	ND	600	no	49	no
Dichlorobenzene, 1,3-	0	46	ND	NA	no	14	no
Dichlorobenzene, 1,4-	0	46	ND	75	no	0.47	no
Dichlorobenzidine, 3,3'-	0	23	ND	NA	no	0.15	no
Dichloroethane, 1,1-	0	23	ND	NA	no	1200	no
Dichloroethene, 1,1-	0	23	ND	7	no	340	no
Dichloroethene, 1,2- (total)	0	23	ND	70	no	61	no
Dichloroethene, cis-1,2-	0	23	ND	70	no	61	no
Dichloroethene, trans-1,2-	0	23	ND	100	no	110	no
Dichlorophenol, 2,4-	0	23	ND	NA	no	110	no
Dichloropropane, 1,2-	0	23	ND	5	no	0.16	no
Dichloropropene, cis-1,3-	0	23	ND	NA	no	0.4	no
Dichloropropene, trans-1,3-	0	23	ND	NA	no	0.4	no
Dieldrin	0	23	ND	NA	no	0.0042	no
Diethyl phthalate	0	23	ND	NA	no	29000	no
Dimethyl phthalate	0	23	ND	NA	no	370000	no
Dimethylphenol, 2,4-	0	23	ND	NA	no	730	no
Di-n-butyl phthalate	5	23	1.4	NA	no	3700	no
Dinitro-2-methylphenol, 4,6-	0	23	ND	NA	no	NA	no
Dinitrophenol, 2,4-	0	23	ND	NA	no	73	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 2B
Summary of Off-Site Alluvial Groundwater Data (September and November 2008 Sampling Rounds)
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Dinitrotoluene, 2,4-	0	47	ND	NA	no	73	no
Di-n-octyl phthalate	0	23	ND	NA	no	NA	no
Dinoseb	0	46	ND	7	no	37	no
Dioxane, 1,4-	2	2	5.5	NA	no	6.1	no
Endosulfan I	0	23	ND	NA	no	220	no
Endosulfan II	0	23	ND	NA	no	220	no
Endosulfan sulfate	0	23	ND	NA	no	220	no
Endrin	0	23	ND	2	no	11	no
Endrin aldehyde	0	23	ND	NA	no	NA	no
Endrin ketone	0	23	ND	NA	no	NA	no
Erucylamide	4	4	17	NA	no	NA	no
Ethylbenzene	0	23	ND	700	no	1300	no
Fluoranthene	0	23	ND	NA	no	1500	no
Fluorene	0	23	ND	NA	no	240	no
Fluorobiphenyl, 2-	24	24	45	NA	no	NA	no
Fluorophenol, 2-	24	24	74	NA	no	NA	no
Heptachlor	0	23	ND	0.1	no	0.015	no
Heptachlor epoxide	0	23	ND	0.2	no	0.0074	no
Hexachlorobenzene	0	23	ND	1	no	0.042	no
Hexachlorobutadiene	0	23	ND	NA	no	0.86	no
Hexachlorocyclohexane, alpha (a-BHC)	0	23	ND	NA	no	0.011	no
Hexachlorocyclohexane, beta (b-BHC)	0	23	ND	NA	no	0.037	no
Hexachlorocyclohexane, delta (d-BHC)	3	23	0.05	NA	no	NA	no
Hexachlorocyclohexane, gamma (g-BHC)	0	23	ND	0.2	no	0.052	no
Hexachlorocyclopentadiene	0	23	ND	50	no	220	no
Hexachloroethane	0	23	ND	NA	no	4.8	no
Hexanone, 2-	19	27	98	NA	no	NA	no
Indeno(1,2,3-cd)pyrene	0	23	ND	NA	no	0.029	no
Isophorone	0	23	ND	NA	no	71	no
Methoxychlor	0	23	ND	40	no	180	no
Methyl-2-pentanone, 4- (MIBK)	0	23	ND	NA	no	2000	no
Methylene chloride	0	23	ND	5	no	4.3	no
Methylnaphthalene, 2-	0	23	ND	NA	no	NA	no
Methyl-N-methylcarbamate, O-	4	4	24	NA	no	NA	no
Methylphenol, 2-	0	23	ND	NA	no	NA	no
Methylphenol, 3- & Methylphenol, 4-	0	23	ND	NA	no	180	no
Naphthalene	0	23	ND	NA	no	6.2	no
Nickel	23	23	84.3	NA	no	730	no
Nitroaniline, 2-	0	23	ND	NA	no	110	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 2B
Summary of Off-Site Alluvial Groundwater Data (September and November 2008 Sampling Rounds)
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (ug/L)	Maximum Contaminant Level (ug/L)	Does maximum detected concentration exceed MCL?	*USEPA Region 6 Residential water level (2007 value) (ug/L)	Does maximum detected concentration exceed USEPA Region 6 residential water level?
Nitroaniline, 3-	0	23	ND	NA	no	NA	no
Nitroaniline, 4-	0	23	ND	NA	no	NA	no
Nitrobenzene	0	23	ND	NA	no	3.4	no
Nitrophenol, 2-	0	23	ND	NA	no	NA	no
Nitrophenol, 4-	0	23	ND	NA	no	290	no
N-Nitrosodi-n-propylamine	0	23	ND	NA	no	0.0096	no
N-Nitrosodiphenylamine	0	23	ND	NA	no	14	no
Pentachlorophenol	0	23	ND	1	no	0.56	no
Phenanthrene	0	23	ND	NA	no	NA	no
Phenol	0	23	ND	NA	no	11000	no
Propanil	0	23	ND	NA	no	180	no
Propene	4	4	8.2	NA	no	NA	no
Pyrene	0	23	ND	NA	no	180	no
Styrene	0	23	ND	100	no	1600	no
Tetrachloroethane, 1,1,2,2-	0	23	ND	NA	no	0.055	no
Tetrachloroethene	0	23	ND	5	no	0.1	no
Toluene	0	23	ND	1000	no	2300	no
Toxaphene	0	23	ND	3	no	0.061	no
Trichlorobenzene, 1,2,4-	0	23	ND	70	no	8.2	no
Trichloroethane, 1,1,1-	0	23	ND	200	no	73000	no
Trichloroethane, 1,1,2-	0	23	ND	5	no	0.2	no
Trichloroethene	0	23	ND	5	no	0.028	no
Trichlorofluoromethane	0	23	ND	NA	no	1300	no
Trichlorophenol, 2,4,5-	0	23	ND	NA	no	3700	no
Trichlorophenol, 2,4,6-	0	23	ND	NA	no	6.1	no

NA - not available
ND - not detected
*USEPA Region 6 Human Health Medium-Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Aldrin	21	180	2.2	0.11	YES
Arsenic	114	123	128	1.8	YES
Chlordane	1	98	23	7.2	YES
Dichloroethane, 1,2-	27	130	7.5	0.84	YES
Dieldrin	36	180	15	0.12	YES
Dinoseb	155	241	29000	680	YES
Hexachlorocyclohexane, beta-	14	180	2.8	1.4	YES
Hexachlorocyclohexane, gamma-	12	180	45	1.9	YES
Propanil	40	151	4000	3400	YES
Tetrachloroethene	9	130	2.1	1.7	YES
Toxaphene	2	180	14	1.7	YES
Acenaphthene	0	187	ND	33000	no
Acenaphthylene	0	187	ND	NA	no
Acetaldehyde	1	1	0.0066	26	no
Acetamide, N-(2-methylphenyl)-	1	1	0.38	NA	no
Acetone	73	130	1300	60000	no
Acetophenone	2	2	0.096	1700	no
Aluminum	28	28	22300	100000	no
Aniline	1	29	0.79	340	no
Anthracene	1	187	0.4	100000	no
Antimony	26	28	0.45	450	no
Aroclor-1016	0	40	ND	24	no
Aroclor-1221	0	40	ND	0.83	no
Aroclor-1232	0	40	ND	0.83	no
Aroclor-1242	0	40	ND	0.83	no
Aroclor-1248	0	40	ND	0.83	no
Aroclor-1254	0	40	ND	0.83	no
Aroclor-1260	0	40	ND	0.83	no
Barium	111	111	398	100000	no
Benzenamine, 2,3-dichloro-	14	14	28	NA	no
Benzene	1	130	0.002	1.6	no
Benzene, (1,1-dimethylpropyl)-	1	1	0.57	NA	no
Benzene, (1-methylbutyl)-	1	1	0.62	NA	no
Benzene, 1,2,3,4-tetramethyl-	1	1	0.39	NA	no
Benzene, 1,2,3,5-tetramethyl-	1	1	0.65	NA	no
Benzene, 1,2,3-trimethyl	7	7	39	NA	no
Benzene, 1,2,4,5-tetramethyl-	1	1	0.013	NA	no
Benzene, 1,2,4-trichloro-	2	2	42	NA	no
Benzene, 1,2,4-trimethyl-	1	1	0.79	NA	no
Benzene, 1,2-dichloro-3-nit	2	2	450	NA	no
Benzene, 1,2-dichloro-4-nitro-	1	1	270	NA	no
Benzene, 1,2-diethyl-	1	1	0.71	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Benzene, 1,3,5-trimethyl-	6	6	15	NA	no
Benzene, 1,3-Dimethyl-	1	1	3.8	NA	no
Benzene, 1,4-dichloro-2-nitro-	3	3	57	NA	no
Benzene, 1-chloro-2-methyl	1	1	0.041	NA	no
Benzene, 1-ethyl-2,3-dimethyl-	1	1	0.28	NA	no
Benzene, 1-ethyl-2-methyl-	6	6	42	NA	no
Benzene, 1-ethyl-3,5-dimethyl-	2	2	1.3	NA	no
Benzene, 1-ethyl-4-methyl	5	5	1.5	NA	no
Benzene, 1-methyl-2-(1-methyle	1	1	16	NA	no
Benzene, 1-methyl-2-(1-methylethyl)	1	1	0.11	NA	no
Benzene, 1-methyl-2-propyl-	1	1	0.14	NA	no
Benzene, 1-methyl-3-(1-methylethyl)	1	1	0.26	NA	no
Benzene, 1-methyl-3-propyl-	1	1	0.52	NA	no
Benzene, 1-methyl-4-(1-methylethyl)-	1	1	0.87	NA	no
Benzene, 1-methyl-4-(1-methylp	1	1	13	NA	no
Benzene, 2-(chloromethyl)-1,3,	1	1	3.9	NA	no
Benzene, 2,4-dichloro-1-(trifluoromethyl)-	1	1	0.016	NA	no
Benzene, 2-ethenyl-1,4-dimethyl-	1	1	0.013	NA	no
Benzene, 2-ethyl-1,3-dimethyl-	1	1	0.16	NA	no
Benzene, 2-ethyl-1,4-dimethyl-	1	1	0.3	NA	no
Benzene, 4-ethyl-1,2-dimethyl-	1	1	0.55	NA	no
Benzene, methoxy-	3	3	38	NA	no
Benzene, propyl-	5	5	1.3	NA	no
Benzene,-1-nitro-2,5-dichloro	3	3	45	NA	no
Benzeneacetic acid, .alpha.-hy	1	1	0.3	NA	no
Benzeneacetonitrile, .alpha.-(	1	1	5.4	NA	no
Benzimidazole, 2-methyl-, 1H-	0	0	ND	NA	no
Benzimidazolo[1,2-a]-1,2,4-tri	1	1	2.7	NA	no
Benzo(a)anthracene	1	187	0.87	2.3	no
Benzo(a)pyrene	0	187	ND	0.23	no
Benzo(b)fluoranthene	0	187	ND	2.3	no
Benzo(g,h,i)perylene	0	150	ND	NA	no
Benzo(k)fluoranthene	0	187	ND	23	no
Benzoic acid	4	176	19	100000	no
Benzoic acid, 2,3,5-trichloro-	3	3	15	NA	no
Benzoic acid, 2-methoxy-4-meth	1	1	7.2	NA	no
Benzoic acid, 3,5-bis(1,1-dime	3	3	18	NA	no
Benzoic acid, 3-chloro-	1	1	0.76	NA	no
Benzoic acid, 3-methyl-, methyl ester	2	2	29	NA	no
Benzoic acid, 4-chloro-2-nitro	1	1	2.7	NA	no
Benzoic acid, 4-methyl-	1	1	1.8	NA	no
Benzoic acid, 4-methyl-, [4-(m	1	1	3.5	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Benzoic acid, 4-methyl-, hydra	1	1	34	NA	no
Benzoic acid, 4-methyl-, methy	4	4	390	NA	no
Benzoic acid, methyl ester	2	2	60	NA	no
Benzyl alcohol	0	176	ND	100000	no
Beryllium	28	28	0.8	2200	no
Biphenyl	7	7	0.04	26000	no
bis(2-Chloroethoxy)methane	0	187	ND	NA	no
bis(2-Chloroethyl) ether	0	187	ND	NA	no
bis(2-Chloroisopropyl) ether	0	179	ND	NA	no
bis(2-Ethylhexyl) phthalate	34	187	5.2	140	no
Bromobenzene	0	28	ND	120	no
Bromochloromethane	0	38	ND	NA	no
Bromodichloromethane	0	120	ND	2.6	no
Bromofluorobenzene, 4-	30	38	2.8	NA	no
Bromoform	0	130	ND	240	no
Bromomethane	0	130	ND	15	no
Bromophenyl phenyl ether, 4-	0	187	ND	NA	no
Butanoic acid	1	1	0.47	NA	no
Butanone, 2- (MEK)	38	130	33	NA	no
Butanone, 3-methyl-, 2-	1	1	0.0094	NA	no
Buten-4-ol, 3-methyl-4-(4-me, 1-	1	1	2.5	NA	no
Butyl benzyl phthalate	0	187	ND	240	no
C12 - C28	0	1	ND	NA	no
C28 - C35	0	1	ND	NA	no
C6 - C12	0	1	ND	NA	no
C6 - C35	0	1	ND	NA	no
Cadmium	36	111	163.8	560	no
Calcium	28	28	20100	NA	no
Carbaryl	1	1	0.65	68000	no
Carbon disulfide	4	130	0.12	720	no
Carbon tetrachloride	0	130	ND	0.58	no
Chlordane, alpha-	6	135	2.8	NA	no
Chlordane, gamma-	4	136	3.5	NA	no
Chloride	6	6	770	NA	no
Chloro-3-methylphenol, 4-	0	187	ND	NA	no
Chloroaniline hydrochloride, o-	1	1	1	NA	no
Chloroaniline, 4-	12	187	12	2700	no
Chlorobenzene	15	131	0.25	500	no
Chloroethane	0	130	ND	NA	no
Chloroethyl vinyl ether, 2-	0	49	ND	NA	no
Chloroform	6	130	0.098	0.58	no
Chloromethane	0	130	ND	170	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Chloronaphthalene, 2-	0	187	ND	NA	no
Chlorooctane, 1-	1	1	43	NA	no
Chlorophenol, 2-	0	187	ND	260	no
Chlorophenyl phenyl ether, 4-	0	187	ND	NA	no
Chromium	110	111	95.3	500	no
Chrysene	4	187	0.87	230	no
Cobalt	28	28	16.9	2100	no
Colchicine, 7-deacetoamino-5,6	1	1	2.8	NA	no
Copper	28	28	19.1	42000	no
Cyano-8-dimethylamino-6-meth, 5-	1	1	0.3	NA	no
Cyclohexane, 1,3-dimethyl-, trans-	1	1	1.4	NA	no
Cyclohexane, 1-ethyl-2-methyl-, cis-	1	1	1.3	NA	no
Cyclohexanone, 3,3,5-trimethyl-	1	1	0.51	NA	no
Cyclopentane, 1,1-dimethyl-	1	1	0.68	NA	no
Cyclopropane, trimethyl(2-methyl-1-propenylidene)-	1	1	0.037	NA	no
Cyclopropanecarboxylic acid, 3	4	4	6	NA	no
DCAA	22	54	0.12	NA	no
DDD, 4,4'-	33	180	0.35	11	no
DDE, 4,4'-	55	180	0.28	7.8	no
DDT, 4,4'-	44	180	1.6	7.8	no
Decachlorobiphenyl	0	53	ND	NA	no
Decane	1	1	1.4	NA	no
Decane, 2-methyl-	1	1	0.97	NA	no
Decane, 3-methyl-	1	1	0.84	NA	no
Decene, 4-methyl-, (z)-, 2-	1	1	0.75	NA	no
Decene, 8-methyl-, (Z)-, 2-	1	1	31	NA	no
Diazene, bis(3,4-dichloropheny	5	5	4.7	NA	no
Dibenz(a,h)anthracene	0	150	ND	0.23	no
Dibenzofuran	0	187	ND	NA	no
Dibromochloromethane	0	130	ND	2.6	no
Dibromoethane, 1,2- (EDB)	0	28	ND	0.07	no
Dibromofluoromethane	30	38	3	NA	no
Dibromomethane	0	28	ND	NA	no
Dichloro-1,1-bis(4-meth, 2,2-	4	4	28	NA	no
Dichloro-1,4,5,8-tetraaza-, 2,3-	1	1	2.2	NA	no
Dichloro-3-methylquinoline, 4,7-	2	2	1.6	NA	no
Dichloro-4-nitroaniline, 2,6-	1	1	0.85	NA	no
Dichloro-6-nitroaniline, 2,4-	1	1	0.45	NA	no
Dichloroaniline, 3,4-	52	153	12000	NA	no
Dichlorobenzene, 1,2-	46	220	17	370	no
Dichlorobenzene, 1,3-	6	220	0.056	140	no
Dichlorobenzene, 1,4-	15	220	7	8.1	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Dichlorobenzidine, 3,3'-	0	187	ND	4.3	no
Dichloroethane, 1,1-	0	130	ND	2300	no
Dichloroethene, 1,1-	1	130	0.002	470	no
Dichloroethene, 1,2- (total)	2	109	0.012	160	no
Dichloroethene, cis-1,2-	3	33	0.012	160	no
Dichloroethene, trans-1,2-	0	49	ND	200	no
Dichlorophenol, 2,4-	0	187	ND	2100	no
Dichlorophenol, 2,6-	1	1	0.16	NA	no
Dichloropropane, 1,2-	0	130	ND	0.85	no
Dichloropropene, cis-1,3-	0	130	ND	NA	no
Dichloropropene, trans-1,3-	0	130	ND	NA	no
Diethyl phthalate	0	187	ND	100000	no
Dimethoxymethyl-4-nitrobenze, 1-	1	1	0.28	NA	no
Dimethyl phthalate	4	187	6.7	NA	no
Dimethyl terephthalate	3	3	23	NA	no
Dimethylphenol, 2,4-	0	187	ND	14000	no
Di-n-butyl phthalate	13	187	2.7	68000	no
Dinitro-2-methylphenol, 4,6-	1	187	1.3	NA	no
Dinitrophenol, 2,4-	3	187	12	1400	no
Dinitrotoluene, 2,4-	0	187	ND	1400	no
Dinitrotoluene, 2,6-	0	187	ND	680	no
Di-n-octyl phthalate	4	187	4.3	NA	no
Dioxane, 1,4-	2	2	0.34	170	no
Dioxolane, 2-(4-methoxyphe, 1,3-	1	1	0.36	NA	no
Diphenyl ether	1	1	0.0073	NA	no
Dodecanamide	1	1	3.2	NA	no
Dodecane	1	1	4.5	NA	no
Dodecanoic acid	1	1	0.55	NA	no
Dodecene, (E)-, 5-	1	1	6.4	NA	no
Dodecene, 1-	1	1	23	NA	no
Eicosane	1	1	0.53	NA	no
Endosulfan I	1	180	0.032	NA	no
Endosulfan II	2	180	0.072	NA	no
Endosulfan Sulfate	4	180	4.9	NA	no
Endrin	9	180	0.25	NA	no
Endrin aldehyde	4	98	0.3	NA	no
Endrin ketone	8	141	0.77	NA	no
Erucylamide	18	18	1.8	NA	no
Ethane, isocyano-	1	1	4.5	NA	no
Ethanone, 2-hydroxy-1,2-bis	1	1	2.1	NA	no
Ethenamine, N-methylene-	1	1	6.4	NA	no
Ethyl acetate	3	3	0.12	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Ethylbenzene	22	130	40	230	no
Ethyldecane, 5-	1	1	18	NA	no
Fluoranthene	3	187	0.19	24000	no
Fluorene	1	187	0.075	26000	no
Fluorobiphenyl, 2-	39	53	2	NA	no
Fluorophenol, 2-	39	53	2.9	NA	no
Heneicosane	1	1	26	NA	no
Heptachlor	5	180	0.15	0.43	no
Heptachlor Epoxide	1	180	0.027	0.21	no
Heptadecane	1	1	9	NA	no
Heptane	1	1	0.044	NA	no
Heptanone, 2,6-dimethyl-, 4-	5	5	0.034	NA	no
Hexachlorobenzene	1	187	0.23	1.2	no
Hexachlorobutadiene	0	187	ND	25	no
Hexachlorocyclohexane, alpha-	7	180	0.014	0.4	no
Hexachlorocyclohexane, delta-	4	180	2.1	NA	no
Hexachlorocyclopentadiene	0	187	ND	4100	no
Hexachloroethane	0	187	ND	140	no
Hexadecane	1	1	7.9	NA	no
Hexanol, 4-ethyl-, 3-	1	1	0.23	NA	no
Hexanone, 2-	1	130	0.003	NA	no
Hexyne, 2-	2	2	0.28	NA	no
Indene, 2,3-dihydro-4,7-dim, 1H-	1	1	1.5	NA	no
Indene, 2,3-dihydro-4-methyl, 1H-	1	1	0.28	NA	no
indene, octahydro-5-methyl-, 1H-	1	1	0.5	NA	no
Indeno(1,2,3-cd)pyrene	0	187	ND	2.3	no
Iron	28	28	25500	40000	no
Isobenzazol, 1,3-dioxo-2-met, 2-	1	1	2.9	NA	no
Isoindole-1,3(2H)-dione, 2-, 1H-	1	1	1	NA	no
Isophorone	8	187	15	2000	no
Isopropyl alcohol	1	1	0.019	NA	no
Lead	111	111	65.9	800	no
Magnesium	37	37	7030	NA	no
Manganese	19	19	2690	35000	no
Mercury	26	107	111.7	340	no
Methano-1H-indene, 3a,4,7,7a-te, 4,7-	1	1	0.1	NA	no
Methoxychlor	80	183	910	3400	no
Methyl Isobutyl Ketone	1	1	0.33	NA	no
Methyl-2-Pentanone, 4- (MIBK)	18	130	24	17000	no
Methyl-3-(2-chloro-6-hydroxy, 2-	1	1	0.43	NA	no
Methyl-3-(2'-chlorophenyl)-5, 2-	1	1	0.29	NA	no
Methyl-6-propylphenol, 2-	1	1	0.48	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Methylene chloride	35	130	4	22	no
Methylnaphthalene, 1-	9	9	0.34	NA	no
Methylnaphthalene, 2-	2	187	0.49	NA	no
Methylphenol, 2-	1	29	0.89	NA	no
Methylphenol, 2- (o-Cresol)	0	158	ND	NA	no
Methylphenol, 3- & Methylphenol, 4-	2	29	0.33	NA	no
Methylphenol, 4- (p-Cresol)	0	158	ND	3400	no
Morpholine	1	1	1.3	NA	no
Morpholine, 4-propionyl-	2	2	21	NA	no
N,N-Dimethylformamide	2	2	1.1	NA	no
Naphthalene	4	188	2.7	210	no
Naphthalene, 2-methyl-	1	1	0.025	NA	no
Naphthalene, decahydro-, trans-	1	1	1.5	NA	no
Naphthalene, decahydro-2-methyl-	2	2	0.61	NA	no
Naphthalenol, 1-	1	1	0.47	NA	no
n-Heptadecylcyclohexane	1	1	4.9	NA	no
Nickel	28	28	28.6	23000	no
Nitroaniline, 2-	0	187	ND	2000	no
Nitroaniline, 3-	0	180	ND	NA	no
Nitroaniline, 4-	0	187	ND	NA	no
Nitrobenzene	0	187	ND	110	no
Nitrophenol, 2-	0	187	ND	NA	no
Nitrophenol, 4-	2	187	8.1	5500	no
N-Nitrosodi-n-propylamine	0	187	ND	0.27	no
N-Nitrosodiphenylamine	0	187	ND	390	no
N-Nitrosomorpholine	1	1	0.45	NA	no
Nonadecane	1	1	0.78	NA	no
Nonanediol, 8-methyl-, 1,8-	2	2	0.37	NA	no
Octadecenamide, (Z)-, 9-	8	8	1.4	NA	no
Octane, 3,3-dimethyl-	1	1	0.74	NA	no
Octanoic Acid	1	1	0.24	NA	no
Octanol, 3-	1	1	0.24	NA	no
Oxybis(2-chloro)propane/bis(2-cl, 2,2-	0	8	ND	NA	no
Pentachlorobenzene	4	4	4.2	550	no
Pentachlorophenol	0	187	ND	10	no
Pentanoic acid	1	1	0.62	NA	no
Pentanone, 2,2,4,4-tetramethyl-, 3-	5	5	6.2	NA	no
Pentaoxabicyclo[15, 3,6,9,12,15-	1	1	1.5	NA	no
Penten-2-one, 4-methyl-, 3-	2	2	190	NA	no
Permethrin	4	4	4.9	34000	no
Phenanthrene	2	187	0.36	NA	no
Phenanthrene, 1,2,3,4,5,6,7,8-	1	1	41	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Phenol	8	187	6.9	NA	no
Phenol, (1,1,3,3-tetramethylbu	4	4	3	NA	no
Phenol, 2-(1-methylpropyl)-	2	2	14	NA	no
Phenol, 4-(1,1,3,3-tetramethyl	1	1	0.25	NA	no
Phenol, 4-(1-methylpropyl)-	1	1	7.5	NA	no
Potassium	28	28	2050	NA	no
Propanoic acid	2	2	2.6	NA	no
Propen-1-ol, 2-	1	1	0.045	NA	no
Propene, 3,3'-oxybis-, 1-	1	1	0.0098	NA	no
Propylbiphenyl-4'-carboxylic, 4-	2	2	9.6	NA	no
p-tert-Amyl phenoxy ethanol	2	2	2.2	NA	no
Pyrene	3	187	0.16	32000	no
Quinoline, 7-chloro-2-methyl-	1	1	13	NA	no
Selenium	31	111	70.9	5700	no
Silver	16	111	89.9	5700	no
S-Indacene-1,7-dione, 2,3,5	1	1	0.46	NA	no
Sodium	26	28	3620	NA	no
s-Triazolo[1,5-a]pyridine, 8-a	1	1	5.7	NA	no
Styrene	0	130	ND	1700	no
Sulfate	2	2	190	NA	no
Terphenyl, o-	1	1	46	NA	no
Tetrachlorobenzene, 1,2,3,5-	8	8	19	NA	no
Tetrachloroethane, 1,1,2,2-	0	130	ND	0.97	no
Tetrachloro-m-xylene	0	53	ND	NA	no
Tetracosane	2	2	5.7	NA	no
Tetradecanamide	4	4	2.9	NA	no
Tetramethylbicyclo[6.3, 1,2,4,8-	1	1	0.28	NA	no
tetramethylcyclo, 1.Alpha.,2.beta.,3.alpha.,4.beta.-	1	1	0.62	NA	no
Tetratriacontane	1	1	18	NA	no
Thallium	28	28	0.4	79	no
Toluene	50	130	510	520	no
Triazole-4-carboxalde, 2H-1,2,3-	1	1	0.36	NA	no
Tribromophenol, 2,4,6-	39	53	2.9	NA	no
Trichlorobenzene, 1,2,4-	5	187	5.2	260	no
Trichloroethane, 1,1,1-	0	130	ND	1400	no
Trichloroethane, 1,1,2-	1	130	0.00075	2.1	no
Trichloroethene	2	130	0.0069	NA	no
Trichlorofluoromethane	0	33	ND	1400	no
Trichlorophenol, 2,4,5-	0	187	ND	68000	no
Trichlorophenol, 2,4,6-	0	187	ND	170	no
Tricyclo[3.3.3.01,5]undec-6	1	1	2.4	NA	no
Tridecane	1	1	1.9	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 3
Screening of Chemicals of Potential Concern in 0 to 10 feet bgs On-Site Soils
Cedar Chemical Site

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*Industrial Outdoor Worker Screening Level (mg/ kg)	Does Maximum Detected Concentration Exceed Sceening Level?
Trimethyl-5,6-dimethyle, 1,1,4a-	2	2	0.44	NA	no
Undecane	2	2	3.9	NA	no
Vanadium	28	28	43	5700	no
Vinyl acetate	0	130	ND	1600	no
Vinyl chloride	0	130	ND	0.86	no
Xylene (total)	38	130	140	210	no
Xylene, m- & p-	16	28	120	210	no
Xylene, o-	15	33	27	280	no
Zinc	28	28	74.5	100000	no
Zinc, bis[2-(1,1-dimethylethyl)-3,3-dimethylcyclop	1	1	1.6	NA	no

NA - Not Available
ND - Not Detected
*from USEPA Region 6 Human Health Medium Specific Screening Levels (12/4/2007)

Table 4
Summary of Soil Data from All Depths-
Comparison to USEPA Groundwater Protection Soil Screening Levels

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*USEPA Soil Screening Level for Groundwater Protection (GWP) x DAF of 20	Does Maximum Detected Concentration in Soil Exceed USEPA Soil Screening Level for GWP?
Acetone	120	211	1300	16	YES
Aldrin	23	255	2.2	0.4	YES
Arsenic	167	179	128	20	YES
Benzene	4	211	0.22	0.04	YES
Carbon tetrachloride	1	211	0.67	0.06	YES
Chlordane (technical)	1	68	23	10	YES
Chloroform	26	211	13	0.6	YES
Chromium	163	164	95.3	40	YES
Dichlorobenzene, 1,4-	19	332	7	2	YES
Dichloroethane, 1,2-	73	211	170	0.02	YES
Dieldrin	39	254	15	0.004	YES
Dimethyl terephthalate	3	3	23	NA	YES
Dinitrophenol, 2,4-	7	276	49	0.2	YES
Endrin	13	254	0.68	0.2	YES
Ethylbenzene	35	211	40	14	YES
Hexachlorocyclohexane, alpha-	16	254	0.21	0.0006	YES
Hexachlorocyclohexane, beta-	15	254	2.8	0.002	YES
Hexachlorocyclohexane, gamma-	14	255	45	0.01	YES
Isophorone	12	276	67	0.6	YES
Methoxychlor	95	257	910	160	YES
Methylene chloride	93	211	380	0.02	YES
Selenium	37	164	70.9	6	YES
Silver	22	164	89.9	40	YES
Toluene	85	211	510	12	YES
Trichlorobenzene, 1,2,4-	9	279	42	6	YES
Acenaphthene	ND	276	0	540	no
Acenaphthylene	ND	276	0	NA	no
Acetaldehyde	2	2	0.018	NA	no
Acetamide, N-(2-methylphenyl)-	1	1	0.38	NA	no
Acetamide, N,N-dimethyl-	1	1	1.9	NA	no
Acetophenone	4	4	0.25	NA	no
Aluminum	40	40	22300	NA	no
Aniline	1	41	0.79	NA	no
Anthracene	1	276	0.4	11800	no
Antimony	38	40	0.64	6	no
Aroclor-1016	ND	57	0	NA	no
Aroclor-1221	ND	57	0	NA	no
Aroclor-1232	ND	57	0	NA	no
Aroclor-1242	ND	57	0	NA	no
Aroclor-1248	ND	57	0	NA	no
Aroclor-1254	ND	57	0	NA	no
Aroclor-1260	ND	57	0	NA	no
Barium	164	164	398	NA	no
Benzenamine, 2,3-dichloro-	1	1	21	NA	no
Benzenamine, 2,5-dichloro-	9	9	28	NA	no
Benzenamine, 2,6-dichloro-	3	3	5.7	NA	no
Benzenamine, 3,5-dichloro-	3	3	12	NA	no
Benzene, (1,1-dimethylpropyl)-	1	1	0.57	NA	no
Benzene, (1-methylbutyl)-	1	1	0.62	NA	no
Benzene, 1,2,3,4-tetramethyl-	1	1	0.39	NA	no
Benzene, 1,2,3,5-tetramethyl-	1	1	0.65	NA	no
Benzene, 1,2,4,5-tetramethyl-	1	1	0.013	NA	no
Benzene, 1,2-dichloro-3-nit	2	2	450	NA	no
Benzene, 1,2-dichloro-4-nitro-	1	1	270	NA	no
Benzene, 1,2-diethyl-	1	1	0.71	NA	no
Benzene, 1,3-diethyl-	3	3	2.9	NA	no
Benzene, 1,3-Dimethyl-	1	1	3.8	NA	no
Benzene, 1,4-dichloro-2-nitro-	3	3	57	NA	no
Benzene, 1-chloro-2-methyl	1	1	0.041	NA	no
Benzene, 1-chloro-3-(2-phenyle	1	1	1.2	NA	no
Benzene, 1-ethyl-2,3-dimethyl-	2	2	3.5	NA	no

NA - Not available
ND - Not detected
*from USEPA Region 6 Human Health Medium Specific
Screening Levels (12/4/2007);
USEPA values multiplied by a DAF of 20

Table 4
Summary of Soil Data from All Depths-
Comparison to USEPA Groundwater Protection Soil Screening Levels

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*USEPA Soil Screening Level for Groundwater Protection (GWP) x DAF of 20	Does Maximum Detected Concentration in Soil Exceed USEPA Soil Screening Level for GWP?
Benzene, 1-ethyl-2-methyl-	10	10	88	NA	no
Benzene, 1-ethyl-3,5-dimethyl-	2	2	1.3	NA	no
Benzene, 1-ethyl-3-methyl-	1	1	1.1	NA	no
Benzene, 1-ethyl-4-methyl	8	8	19	NA	no
Benzene, 1-methyl-2-(1-methyle	2	2	16	NA	no
Benzene, 1-methyl-2-propyl-	1	1	0.14	NA	no
Benzene, 1-methyl-3-(1-methylethyl)	1	1	0.26	NA	no
Benzene, 1-methyl-3-propyl-	2	2	22	NA	no
Benzene, 1-methyl-4-(1-methylethyl)	2	2	1.8	NA	no
Benzene, 1-methyl-4-(1-methylp	1	1	13	NA	no
Benzene, 2-(chloromethyl)-1,3,	1	1	3.9	NA	no
Benzene, 2,4-dichloro-1-(trifluoromethyl)-	1	1	0.016	NA	no
Benzene, 2-ethenyl-1,4-dimethyl-	1	1	0.013	NA	no
Benzene, 2-ethyl-1,3-dimethyl-	2	2	0.3	NA	no
Benzene, 4-ethyl-1,2-dimethyl-	3	3	12	NA	no
Benzene, methoxy-	3	3	38	NA	no
Benzene, propyl	7	7	17	NA	no
Benzene,-1-nitro-2,5-dichloro	3	3	45	NA	no
Benzeneacetic acid, .alpha.-hy	1	1	0.3	NA	no
Benzeneacetonitrile, .alpha.-(	1	1	5.4	NA	no
Benzimidazol-2-one, 1,3-dih, 2H-	1	1	0.28	NA	no
Benzimidazole, 2-methyl-, 1H-	1	1	0.21	NA	no
Benzimidazolo[1,2-a]-1,2,4-tri	1	1	2.7	NA	no
Benzo(a)anthracene	1	276	0.87	1.6	no
Benzo(a)pyrene	ND	276	0	8	no
Benzo(b)fluoranthene	ND	276	0	4	no
Benzo(g,h,i)perylene	ND	234	0	NA	no
Benzo(k)fluoranthene	ND	276	0	40	no
Benzoic acid	7	237	19	400	no
Benzoic acid, 2,3,5-trichloro-	1	1	15	NA	no
Benzoic acid, 2-chloro-6-nitro	2	2	26	NA	no
Benzoic acid, 2-methoxy-4-meth	1	1	7.2	NA	no
Benzoic acid, 3,5-bis(1,1-dime	7	7	18	NA	no
Benzoic acid, 3-chloro-	2	2	0.77	NA	no
Benzoic acid, 3-chloro-, methy	1	1	0.98	NA	no
Benzoic acid, 3-methyl-, methyl ester	2	2	29	NA	no
Benzoic acid, 4-chloro-2-nitro	2	2	5	NA	no
Benzoic acid, 4-methyl-	1	1	1.8	NA	no
Benzoic acid, 4-methyl-, [4-(m	1	1	3.5	NA	no
Benzoic acid, 4-methyl-, hydra	1	1	34	NA	no
Benzoic acid, 4-methyl-, methy	5	5	390	NA	no
Benzoic acid, methyl ester	2	2	60	NA	no
Benzyl alcohol	ND	237	0	NA	no
Beryllium	40	40	0.8	60	no
Biphenyl	11	11	0.093	NA	no
Bis(1,1-dimethylethyl)-4-(, 2,6-	1	1	91	NA	no
bis(2-Chloroethoxy)methane	ND	276	0	NA	no
bis(2-Chloroethyl) ether	1	276	0.18	NA	no
bis(2-Chloroisopropyl) ether	ND	260	0	NA	no
bis(2-Ethylhexyl) phthalate	44	276	5.2	140	no
Bromobenzene	ND	40	0	NA	no
Bromochloromethane	ND	40	0	NA	no
Bromodichloromethane	1	211	0.017	0.6	no
Bromofluorobenzene, 4-	43	56	2.8	NA	no
Bromoform	1	211	0.1	0.8	no
Bromomethane	ND	211	0	0.2	no
Bromophenyl phenyl ether, 4-	ND	276	0	NA	no
Butanal	1	1	0.0065	NA	no
Butanoic acid	2	2	22	NA	no
Butanone, 2- (MEK)	59	211	44	NA	no
Butanone, 3-methyl-, 2-	1	1	0.0094	NA	no

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USEPA values multiplied by a DAF of 20

Table 4
Summary of Soil Data from All Depths-
Comparison to USEPA Groundwater Protection Soil Screening Levels

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*USEPA Soil Screening Level for Groundwater Protection (GWP) x DAF of 20	Does Maximum Detected Concentration in Soil Exceed USEPA Soil Screening Level for GWP?
Buten-4-ol, 3-methyl-4-(4-me, 1-	1	1	2.5	NA	no
Butene, 4-cyclopropyl-, 1-	1	1	0.062	NA	no
Butyl benzyl phthalate	ND	276	0	16200	no
Butyl-tert-butyl-isopropoxybor	1	1	1.3	NA	no
Cadmium	65	164	163.8	NA	no
Carbaryl	1	1	0.65	NA	no
Carbon disulfide	4	211	0.12	40	no
Chlordane	ND	62	0	10	no
Chlordane, alpha-	6	192	2.8	NA	no
Chlordane, gamma-	5	193	3.5	NA	no
Chloro-3-methylphenol, 4-	ND	276	0	NA	no
Chloro-4-nitrobenzhydrazide, 2-	1	1	0.89	NA	no
Chloroaniline hydrochloride, o-	1	1	1	NA	no
Chloroaniline, 4-	16	276	12	NA	no
Chlorobenzene	21	212	0.53	1.4	no
Chloroethane	ND	211	0	NA	no
Chloroethyl vinyl ether, 2-	ND	88	0	NA	no
Chloromethane	ND	211	0	NA	no
Chloronaphthalene, 2-	4	276	5.4	NA	no
Chlorooctane, 1-	1	1	43	NA	no
Chlorophenol, 2-	ND	276	0	4	no
Chlorophenyl phenyl ether, 4-	ND	276	0	NA	no
Chrysene	4	276	0.87	28	no
Cobalt	40	40	16.9	NA	no
Colchicine, 7-deacetoamino-5,6	1	1	2.8	NA	no
Copper	40	40	19.1	NA	no
Cyano-8-dimethylamino-6-meth, 5-	1	1	0.3	NA	no
Cyclohexane, 1,3-dimethyl-, trans-	1	1	1.4	NA	no
Cyclohexane, 1-ethyl-2-methyl-, cis-	1	1	1.3	NA	no
Cyclohexanecarboxylic acid, 1-	1	1	2.3	NA	no
Cyclohexanone, 3,3,5-trimethyl-	1	1	0.51	NA	no
Cyclopentane, 1,1-dimethyl-	1	1	0.68	NA	no
Cyclopropane, trimethyl(2-methyl-1-proper	1	1	0.037	NA	no
Cyclopropanecarboxylic acid, 3	6	6	6	NA	no
Cyclopropanecarboxylic acid, 3, 1	2	2	53	NA	no
Cyclopropanecarboxylic acid, 3, 2	2	2	55	NA	no
DCAA	36	69	0.12	NA	no
DDD, 4,4'-	34	254	0.35	16	no
DDE, 4,4'-	55	255	0.28	60	no
DDT, 4,4'-	47	254	1.6	40	no
Decane	1	1	1.4	NA	no
Decane, 2-methyl-	1	1	0.97	NA	no
Decane, 3-methyl-	1	1	0.84	NA	no
Decene, 4-methyl-, (z)-, 2-	1	1	0.75	NA	no
Decene, 8-methyl-, (Z)-, 2-	1	1	31	NA	no
Diazene, bis(3,4-dichloropheny	7	7	4.7	NA	no
Dibenz(a,h)anthracene	ND	234	0	1.6	no
Dibenzofuran	ND	276	0	NA	no
Dibromochloromethane	1	211	0.074	0.4	no
Dibromoethane, 1,2- (EDB)	ND	40	0	NA	no
Dibromofluoromethane	43	56	3	NA	no
Dibromomethane	ND	40	0	NA	no
Dichloro-1,1-bis(4-meth, 2,2-	4	4	28	NA	no
Dichloro-1,4,5,8-tetraaza-, 2,3-	1	1	2.2	NA	no
Dichloro-3-methylquinoline, 4,7-	3	3	1.6	NA	no
Dichloro-4-nitroaniline, 2,6-	1	1	0.85	NA	no
Dichloro-6-nitroaniline, 2,4-	1	1	0.45	NA	no
Dichloroaniline, 3,4-	68	226	12000	NA	no
Dichlorobenzene, 1,2-	64	332	17	18	no
Dichlorobenzene, 1,3-	8	332	0.19	NA	no
Dichlorobenzidine, 3,3'-	ND	276	0	0.006	no

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USEPA values multiplied by a DAF of 20

Table 4
Summary of Soil Data from All Depths-
Comparison to USEPA Groundwater Protection Soil Screening Levels

Chemical	Number of Detects	Number of Analyses	Maximum Detected Concentration (mg/kg)	*USEPA Soil Screening Level for Groundwater Protection (GWP) x DAF of 20	Does Maximum Detected Concentration in Soil Exceed USEPA Soil Screening Level for GWP?
Dichloroethane, 1,1-	ND	211	0	20	no
Dichloroethene, 1,1-	1	211	0.002	0.06	no
Dichloroethene, 1,2- (total)	3	163	0.012	0.04	no
Dichloroethene, cis-1,2-	5	56	0.012	0.04	no
Dichloroethene, trans-1,2-	ND	88	0	0.06	no
Dichlorophenol, 2,4-	ND	276	0	1	no
Dichlorophenol, 2,6-	1	1	0.16	NA	no
Dichloropropane, 1,2-	1	211	0.032	NA	no
Dichloropropene, cis-1,3-	ND	211	0	0.02	no
Dichloropropene, trans-1,3-	ND	211	0	0.004	no
Diethyl phthalate	ND	276	0	NA	no
Dimethoxybenzophenone, 4,4'-	1	1	0.23	NA	no
Dimethoxymethyl-4-nitrobenze, 1-	1	1	0.28	NA	no
Dimethyl phthalate	1	41	6.7	NA	no
Dimethylphenol, 2,4-	ND	276	0	8	no
Dimethylphthalate	3	235	0.18	NA	no
Di-n-butyl phthalate	29	276	3.2	NA	no
Dinitro-2-methylphenol, 4,6-	3	276	1.4	NA	no
Dinitrotoluene, 2,4-	ND	552	0	0.0008	no
Di-n-octyl phthalate	4	276	4.3	NA	no
Dinoseb	199	345	29000	NA	no
Dioxane, 1,4-	2	2	0.34	NA	no
Dioxolane, 2-(4-methoxyphe, 1,3-	1	1	0.36	NA	no
Diphenyl ether	4	4	0.031	NA	no
Dodecanamide	1	1	3.2	NA	no
Dodecane	1	1	4.5	NA	no
Dodecanoic acid	1	1	0.55	NA	no
Dodecanol, 3-	1	1	0.24	NA	no
Dodecene, (E)-, 5-	1	1	6.4	NA	no
Dodecene, 1-	2	2	23	NA	no
Eicosane	1	1	0.53	NA	no
Endosulfan I	1	254	0.032	18	no
Endosulfan II	5	255	0.072	NA	no
Endosulfan Sulfate	4	254	4.9	NA	no
Endrin aldehyde	6	130	0.3	NA	no
Endrin ketone	9	204	0.77	NA	no
Erucylamide	25	25	1.8	NA	no
Ethane, isocyano-	1	1	4.5	NA	no
Ethanol	1	1	0.069	NA	no
Ethanone, 2-hydroxy-1,2-bis	1	1	2.1	NA	no
Ethenamine, N-methylene-	1	1	6.4	NA	no
Ethyl acetate	3	3	0.12	NA	no
Ethyldecane, 5-	1	1	18	NA	no
Fluoranthene	3	276	0.19	4200	no
Fluorene	1	276	0.075	560	no
Fluorobiphenyl, 2-	54	69	2	NA	no
Fluorophenol, 2-	54	69	3.1	NA	no
Heneicosane	1	1	26	NA	no
Heptachlor	8	254	0.27	20	no
Heptachlor Epoxide	1	255	0.027	0.6	no
Heptadecane	1	1	9	NA	no
Heptane	1	1	0.044	NA	no
Heptanone, 2,6-dimethyl-, 4-	6	6	0.034	NA	no
Hexachlorobenzene	1	276	0.23	2	no
Hexachlorobutadiene	ND	276	0	2	no
Hexachlorocyclohexane, delta-	4	255	2.1	NA	no
Hexachlorocyclopentadiene	ND	276	0	400	no
Hexachloroethane	ND	276	0	4	no
Hexadecane	1	1	7.9	NA	no
Hexanol, 1-	1	1	0.29	NA	no
Hexanol, 4-ethyl-, 3-	1	1	0.23	NA	no

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Table 4
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Hexanone, 2-	2	211	0.014	NA	no
Hexyne, 2-	1	1	0.28	NA	no
Indene, 2,3-dihydro-4,7-dim, 1H-	1	1	1.5	NA	no
Indene, 2,3-dihydro-4-methyl, 1H-	1	1	0.28	NA	no
indene, octahydro-5-methyl-, 1H-	1	1	0.5	NA	no
Indeno(1,2,3-cd)pyrene	ND	276	0	14	no
Iron	40	40	25500	NA	no
Isobenzazol, 1,3-dioxo-2-met, 2-	1	1	2.9	NA	no
Isoindole-1,3(2H)-dione, 2-, 1H-	1	1	1	NA	no
Isopropyl alcohol	2	2	0.055	NA	no
Isosafrole (cis & trans)	1	1	0.11	NA	no
Lead	164	164	65.9	NA	no
Magnesium	40	40	15400	NA	no
Manganese	40	40	2690	NA	no
Mercury	38	160	111.7	NA	no
Methano-1H-indene, 3a,4,7,7a-te, 4,7-	1	1	0.1	NA	no
Methyl 2-chloro-4-nitrobenzoat	1	1	0.48	NA	no
Methyl Isobutyl Ketone	1	1	0.33	NA	no
Methyl-2-Pentanone, 4- (MIBK)	40	211	24	NA	no
Methyl-3-(2-chloro-6-hydroxy, 2-	1	1	0.43	NA	no
Methyl-3-(2'-chlorophenyl)-5, 2-	1	1	0.29	NA	no
Methyl-6-propylphenol, 2-	1	1	0.48	NA	no
Methylnaphthalene, 1-	12	12	0.34	NA	no
Methylnaphthalene, 2-	3	276	0.49	NA	no
Methylphenol, 2-	4	41	0.89	NA	no
Methylphenol, 2- (o-Cresol)	1	235	0.002	NA	no
Methylphenol, 3- & Methylphenol, 4-	5	41	0.88	NA	no
Methylphenol, 4- (p-Cresol)	ND	235	0	NA	no
Morpholine	1	1	1.3	NA	no
Morpholine, 4-propionyl-	3	3	21	NA	no
N,N-Dimethylformamide	4	4	6.3	NA	no
Naphthalene	6	277	2.7	80	no
Naphthalene, 2-methyl-	1	1	0.025	NA	no
Naphthalene, decahydro-, trans-	1	1	1.5	NA	no
Naphthalene, decahydro-2-methyl-	2	2	0.61	NA	no
Naphthalenol, 1-	1	1	0.47	NA	no
n-Heptadecylcyclohexane	1	1	4.9	NA	no
Nickel	40	40	28.6	140	no
Nitroaniline, 2-	ND	276	0	NA	no
Nitroaniline, 3-	ND	257	0	NA	no
Nitroaniline, 4-	ND	276	0	NA	no
Nitrobenzene	ND	276	0	0.14	no
Nitrophenol, 2-	8	276	2.9	NA	no
Nitrophenol, 4-	23	276	25	NA	no
N-Nitrosodi-n-propylamine	ND	276	0	0.00004	no
N-Nitrosodiphenylamine	ND	276	0	1.2	no
N-Nitrosomorpholine	1	1	0.45	NA	no
Nonadecane	1	1	0.78	NA	no
Nonanediol, 8-methyl-, 1,8-	3	3	0.37	NA	no
n-Propylbenzene	3	3	19	NA	no
Octadecenamide, (Z)-, 9-	13	13	1.4	NA	no
Octane, 3,3-dimethyl-	1	1	0.74	NA	no
Octanoic Acid	1	1	0.24	NA	no
Octanol, 3-	2	2	0.26	NA	no
Oxybis(2-chloro)propane/bis(2-cl, 2,2-	ND	16	0	NA	no
Pentachlorobenzene	4	4	4.2	NA	no
Pentachlorophenol	ND	276	0	NA	no
Pentanoic acid	1	1	0.62	NA	no
Pentanone, 2,2,4,4-tetramethyl-, 3-	6	6	6.2	NA	no
Pentanone, 3-methyl-, 2-	1	1	0.018	NA	no
Pentaoxabicyclo[15, 3,6,9,12,15-	1	1	1.5	NA	no

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Penten-2-one, 4-methyl-, 3-	3	3	190	NA	no
Permethrin	5	5	4.9	NA	no
Phenanthrene	2	276	0.36	NA	no
Phenanthrene, 1,2,3,4,5,6,7,8-	1	1	41	NA	no
Phenol	27	276	100	100	no
Phenol, (1,1,3,3-tetramethylbu	2	2	3	NA	no
Phenol, 2-(1-methylpropyl)-	2	2	14	NA	no
Phenol, 2,4-bis(1,1-dimethylet	2	2	0.56	NA	no
Phenol, 4-(1,1,3,3-tetramethyl	1	1	0.25	NA	no
Phenol, 4-(1-methylpropyl)-	1	1	7.5	NA	no
Phosphoric acid, tris(2-eth	1	1	0.35	NA	no
Potassium	40	40	2110	NA	no
Propanal, 2-methyl-	1	1	0.014	NA	no
Propanil	74	223	4000	NA	no
Propanoic acid	3	3	22	NA	no
Propen-1-ol, 2-	1	1	0.045	NA	no
Propene, 3,3'-oxybis-, 1-	1	1	0.0098	NA	no
Propylbiphenyl-4'-carboxylic, 4-	2	2	9.6	NA	no
p-tert-Amyl phenoxy ethanol	2	2	2.2	NA	no
Pyrene	3	276	0.16	3000	no
Quinoline, 7-chloro-2-methyl-	1	1	13	NA	no
S-Indacene-1,7-dione, 2,3,5	1	1	0.46	NA	no
Sodium	38	40	3620	NA	no
s-Triazolo[1,5-a]pyridine, 8-a	1	1	5.7	NA	no
Styrene	1	211	0.18	4	no
Sulfate	2	2	190	NA	no
Terphenyl, o-	1	1	46	NA	no
Tetrachlorobenzene, 1,2,3,5-	8	8	19	NA	no
Tetrachloroethane, 1,1,2,2-	ND	211	0	0.004	no
Tetrachloroethene	13	211	2.5	NA	no
Tetrachloro-m-xylene	ND	68	0	NA	no
Tetracosane	2	2	5.7	NA	no
Tetradecanamide	6	6	2.9	NA	no
Tetramethylbicyclo[6.3, 1,2,4,8-	1	1	0.28	NA	no
tetramethylcyclo, 1.Alpha.,2.beta.,3.alpha.	1	1	0.62	NA	no
Tetrasiloxane, decamethyl-	1	1	2.5	NA	no
Tetratriacontane	1	1	18	NA	no
Thallium	40	40	0.4	NA	no
Toxaphene	2	254	14	40	no
Triazole-4-carboxalde, 2H-1,2,3-	1	1	0.36	NA	no
Tribromophenol, 2,4,6-	54	69	2.9	NA	no
Trichloroethane, 1,1,1-	ND	211	0	2	no
Trichloroethane, 1,1,2-	1	211	0.00075	0.018	no
Trichloroethene	3	211	0.029	NA	no
Trichlorofluoromethane	ND	56	0	NA	no
Trichlorophenol, 2,4,5-	ND	276	0	280	no
Trichlorophenol, 2,4,6-	ND	276	0	0.16	no
Tricyclo[3.3.3.01,5]undec-6	1	1	2.4	NA	no
Tridecane	1	1	1.9	NA	no
Trimethyl-5,6-dimethyle, 1,1,4a-	2	2	0.44	NA	no
Trimethylbenzene, 1,2,3-	13	13	90	NA	no
Trimethylbenzene, 1,2,4-	1	1	0.79	NA	no
Trimethylbenzene, 1,3,5-	1	1	11	NA	no
Trimethylbenzene, 1,3,5-	8	8	33	NA	no
Undecane	3	3	18	NA	no
Vanadium	40	40	43	6000	no
Vinyl acetate	ND	211	0	160	no
Vinyl chloride	ND	211	0	0.014	no
Xylene (total)	63	211	140	200	no
Xylene, m- & p-	19	40	120	200	no
Xylene, o-	1	16	5.9	180	no

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Xylene, o-	19	40	27	180	no
Zinc	40	40	82	12400	no
Zinc, bis[2-(1,1-dimethylethyl)-3,3-dimethy	1	1	1.6	NA	no

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ND - Not detected
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Table 5
On-Site Groundwater
Risk Based Concentrations Based on Vapor Intrusion into On-Site Industrial Building
Cedar Chemical Site

Chemical	Risk-Based Concentration (ug/L)	Basis for Risk Based Concentration
Acetone	*>solubility limit (1,000,000,000 ug/L)	Solubility limit
Aldrin	>solubility limit (17 ug/L)	Solubility limit
2-Butanone (Methyl ethyl ketone)	179,200,000	Hazard quotient of 1
Chlorobenzene	>solubility limit (472,000 ug/L)	Solubility limit
Chloroform	8,940	Excess lifetime cancer risk of 1 x 10^{-5}
1,2-Dichlorobenzene	>solubility limit (156,000 ug/L)	Solubility limit
1,4-Dichlorobenzene	34,800	Excess lifetime cancer risk of 1 x 10^{-5}
1,2-Dichloroethane	14,840	Excess lifetime cancer risk of 1 x 10^{-5}
Dieldrin	>solubility limit (195 ug/L)	Solubility limit
Ethylbenzene	72,000	Hazard quotient of 1
gamma- Hexachlorocyclohexane (Lindane)	>solubility limit (7300 ug/L)	Solubility limit
Methoxychlor	>solubility limit (100 ug/L)	Solubility limit
4-Methyl 2-pentanone (Methyl isobutyl ketone)	>solubility limit (19,000,000 ug/L)	Solubility limit
Methylene chloride	534,000	Excess lifetime cancer risk of 1 x 10^{-5}
Toluene	>solubility limit (526,000 ug/L)	Solubility limit
1,2,4-Trichlorobenzene	>solubility limit (48,800 ug/L)	Solubility limit
m- and p-Xylenes	>solubility limit (161,000 ug/L)	Solubility limit

*calculated risk-based concentration exceeds water solubility limit; water solubility in parenthesis

Table 6
Off-Site Groundwater
Risk Based Concentrations Based on Vapor Intrusion into Residence
Cedar Chemical Site

Chemical	Risk-Based Concentration (ug/L)	Basis for Risk-Based Concentration
Bis(2-chloroethyl) ether	262	Excess lifetime cancer risk of 1 x 10^{-5}
1,2-Dichloroethane	779	Excess lifetime cancer risk of 1 x 10^{-5}

Table 7
On-Site Soil (0 to 10 feet below ground surface)
Risk Based Concentrations Based on Direct Contact with Chemicals in Soil
Industrial Worker and Construction Worker
Cedar Chemical Site

Chemical	Industrial Worker (mg/kg)	Construction Worker (mg/kg)	More Protective RBC (mg/kg)	Basis for More Protective RBC
Aldrin	1.01	9.66	1.01	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
Chlordane (technical)	64.7	543	64.7	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
1,2 Dichloroethane	11.9	10.9	10.9	Excess lifetime cancer risk of 1 x 10^{-5} for construction worker
Dieldrin	1.08	10	1.08	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
Dinoseb	616	238	238	Hazard quotient of 1 for construction worker
beta-Hexachlorocycolhexane (beta-BHC)	9.58	91	9.58	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
gamma-Hexachlorocyclohexane (gamma-BHC)	20.6	173	20.6	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker
Propanil	12,300	4,765	4,765	Hazard quotient of 1 for construction worker
Toxaphene	15.7	149	15.7	Excess lifetime cancer risk of 1 x 10^{-5} for industrial worker

ATTACHMENT A

CALCULATION OF RISK-BASED CONCENTRATIONS FOR CHEMICALS IN ON-SITE GROUNDWATER

VAPOR INTRUSION PATHWAY

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
67641	5.00E+01	Acetone

MORE ↓

ENTER Average soil/groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	5.89E+08	5.89E+08	1.00E+09	5.89E+08

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
309002	5.00E+01	Aldrin

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28) (applies to the thickness of soil strata A, B and C columns)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
1.75E+02	3.22E+03	1.75E+02	1.70E+01	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater co 309002
MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES | X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
78933	5.00E+01	Methylethylketone (2-butanone)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	8.96E+07	8.96E+07	2.23E+08	8.96E+07

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
309002

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
108907	5.00E+01	Chlorobenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	2.50E+05	2.50E+05	4.72E+05	2.50E+05

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
67663	5.00E+01	Chloroform

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
4.47E+03	3.60E+05	4.47E+03	7.92E+06	4.47E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
95501	5.00E+01	1,2-Dichlorobenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	1.51E+06	1.51E+06	1.56E+05	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
106467	5.00E+01	1,4-Dichlorobenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
1.74E+04	5.47E+06	1.74E+04	7.90E+04	1.74E+04

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
107062	5.00E+01	1,2-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
7.42E+03	NA	7.42E+03	8.52E+06	7.42E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES | X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
60571	5.00E+01	Dieldrin

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
8.45E+02	2.43E+04	8.45E+02	1.95E+02	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.
MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	5.00E+01	Ethylbenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
3.60E+04	3.21E+06	3.60E+04	1.69E+05	3.60E+04

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
58899	5.00E+01	gamma-HCH (Lindane)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
8.23E+03	1.14E+05	8.23E+03	7.30E+03	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.
MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
72435	5.00E+01	Methoxychlor

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	2.28E+06	2.28E+06	1.00E+02	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.
MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108101	5.00E+01	Methylisobutylketone (4-methyl-2-

MORE ↓

Totals must add up to value of L_{WT} (cell G28)

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	4.43E+07	4.43E+07	1.90E+07	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75092	5.00E+01	Methylene chloride

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
2.67E+05	4.49E+06	2.67E+05	1.30E+07	2.67E+05

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
108883	5.00E+01	Toluene

MORE ↓

Totals must add up to value of L_{WT} (cell G28)

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	1.54E+07	1.54E+07	5.26E+05	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
120821	5.00E+01	1,2,4-Trichlorobenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	3.94E+04	3.94E+04	4.88E+04	3.94E+04

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
108383	5.00E+01	m-Xylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2440	2440	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	3.55E+05	3.55E+05	1.61E+05	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.

SCROLL DOWN TO "END"

END

ATTACHMENT B

CALCULATION OF RISK-BASED CONCENTRATIONS FOR CHEMICALS IN OFF-SITE GROUNDWATER

VAPOR INTRUSION PATHWAY

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
111444	5.00E+01	Bis(2-chloroethyl)ether

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
2.62E+02	NA	2.62E+02	1.72E+07	2.62E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
107062	5.00E+01	1,2-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
17	200	549	549	0	0	A	SIC	SIC		0.00E+00

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, $\rho_b{}^A$ (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, $\theta_w{}^A$ (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, $\rho_b{}^B$ (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, $\theta_w{}^B$ (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, $\rho_b{}^C$ (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, $\theta_w{}^C$ (cm^3/cm^3)
SIC	1.38	0.481	0.216	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
7.79E+02	NA	7.79E+02	8.52E+06	7.79E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

ATTACHMENT C

CALCULATION OF RISK-BASED CONCENTRATIONS OF CHEMICALS IN SOIL

DIRECT CONTACT SOIL EXPOSURE PATHWAY

Risk-based concentrations (RBCs) for the chemicals of potential concern (COPC) in 0 to 10 feet bgs soils were calculated for the long-term on-site worker (assumed to work outside) and the construction worker. The equations in Figure 1 (taken from USEPA guidance; USEPA, 2009) were used to calculate risk-based concentrations in soil for the direct contact pathway. The equations in Figure 1 indicate default inputs for the on-site long-term worker. These equations were also used to calculate RBCs for the construction worker using exposure parameters appropriate for the construction exposure scenario.

Separate equations were used to calculate values for potential carcinogens and noncarcinogens. While potential carcinogens may also have noncarcinogenic effects, the most protective risk-based concentration in soil for each potentially carcinogenic COPC was its cancer-risk based concentration. For this reason, noncancer risk-based RBCs are not shown for potentially carcinogenic COPCs.

USEPA default exposure assumptions were used for nearly all calculations. Inputs used to calculate RBCs for the long-term worker and the construction worker are summarized in Table 1. Chemical-specific toxicity factors and absorption factors are presented in Table 2.

Due to the relatively short duration of exposure (one year), subchronic reference concentrations (RfCs) and oral reference doses (RfDs) are applicable for calculating RBCs for the construction worker. When available, subchronic RfCs and RfDs are used. In the absence of subchronic values, chronic RfCs and RfDs are used to calculate RBCs.

Of the 9 COPCs identified in 0 to 10 feet bgs soils, 1,2-dichloroethane is considered volatile. For this reason, it is necessary to calculate a volatilization factor for soil (VFs) which relates the concentration in soil to the concentration that will result in outdoor air. Site-specific VFs were calculated for 1,2-dichloroethane using meteorological data from the closest location available (Little Rock) and assume that up to 40 acres of the property may be affected.

Several of the terms used in the calculation of the VFs are chemical-specific; they were derived from physical and chemical information obtained from the USEPA's *Soil Screening Guidance: Technical Background Document* (USEPA, 1996). Information regarding constant variables was obtained from Appendix D of the USEPA's *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (2002). The closest city for which information was available was Little Rock, Arkansas.

The equations and inputs presented in Figure 2 were used to calculate VFs for the volatile chemicals of concern for the long-term worker and construction worker.

References

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USEPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. July 2004. EPA/540/R/99/005

USEPA 2009. USEPA Generic Risk Screening Tables. Spring 2009. Online at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm; accessed on July 24, 2009

Figure 1- Equations for Calculation of Risk-Based Concentrations (RBC)in Soil for Workers Directly Contacting Soil

Noncancer Risk-Based RBCs

- incidental ingestion of soil,

$$SL_{w\text{-}sol\text{-}nc\text{-}ing}\ (mg/kg) = \frac{THQ \times AT_{ow}\left(\frac{365\ days}{year} \times ED_{ow}\ (25\ years)\right) \times BW_{ow}\ (70\ Kg)}{EF_{iw}\left(250\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times \frac{1}{RfD_{o}\left(\frac{mg}{kg\text{-}day}\right)} \times IR_{ow}\left(100\ \frac{mg}{day}\right) \times \left(\frac{10^{-6}\ Kg}{1\ mg}\right)}$$

- inhalation of particulates emitted from soil,

$$SL_{w\text{-}sol\text{-}nc\text{-}inh}\ (mg/kg) = \frac{THQ \times AT_{ow}\left(\frac{365\ days}{year} \times ED_{ow}\ (25\ years)\right)}{EF_{iw}\left(250\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times ET_{ws}\left(\frac{8\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times \frac{1}{RfC\left(\frac{mg}{m^{3}}\right)} \times \left(\frac{1}{VF_{s}\left(\frac{m^{3}}{kg}\right)} + \frac{1}{PEF_{w}\left(\frac{m^{3}}{kg}\right)}\right)}$$

- dermal exposure,

$$SL_{w\text{-}sol\text{-}nc\text{-}der}\ (mg/kg) = \frac{THQ \times AT_{ow}\left(\frac{365\ days}{year} \times ED_{ow}\ (25\ years)\right) \times BW_{ow}\ (70\ Kg)}{EF_{iw}\left(250\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times \left(\frac{1}{RfD_{o}\left(\frac{mg}{kg\text{-}day}\right) \times GIABS}\right) \times SA_{ow}\left(\frac{3300\ cm^{2}}{day}\right) \times AF_{ow}\left(\frac{0.2\ mg}{cm^{2}}\right) \times ABS_{d} \times \left(\frac{10^{-6}\ Kg}{1\ mg}\right)}$$

- Total.

$$SL_{w\text{-}sol\text{-}nc\text{-}tot}\ (mg/kg) = \frac{1}{\frac{1}{SL_{w\text{-}sol\text{-}nc\text{-}ing}} + \frac{1}{SL_{w\text{-}sol\text{-}nc\text{-}der}} + \frac{1}{SL_{w\text{-}sol\text{-}nc\text{-}inh}}}$$

Cancer Risk-Based RBCs

- incidental ingestion of soil,

$$SL_{w\text{-}sol\text{-}ca\text{-}ing}\ (mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right) \times BW_{ow}\ (70\ Kg)}{EF_{iw}\left(250\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times CSF_{o}\left(\frac{mg}{kg\text{-}day}\right)^{-1} \times IR_{ow}\left(100\ \frac{mg}{day}\right) \times \left(\frac{10^{-6}\ Kg}{1\ mg}\right)}$$

- inhalation of particulates emitted from soil,

$$SL_{w\text{-}sol\text{-}ca\text{-}inh}\ (mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right)}{EF_{iw}\left(250\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times ET_{ws}\left(\frac{8\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times IUR\left(\frac{\mu g}{m^{3}}\right)^{-1} \times \left(\frac{1000\ \mu g}{mg}\right) \times \left(\frac{1}{VF_{s}\left(\frac{m^{3}}{kg}\right)} + \frac{1}{PEF_{w}\left(\frac{m^{3}}{kg}\right)}\right)}$$

- dermal exposure,

$$SL_{w\text{-}sol\text{-}ca\text{-}der}\ (mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right) \times BW_{ow}\ (70\ Kg)}{EF_{iw}\left(250\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times \left(\frac{CSF_{o}\left(\frac{mg}{kg\text{-}day}\right)^{-1}}{GIABS}\right) \times SA_{ow}\left(\frac{3300\ cm^{2}}{day}\right) \times AF_{ow}\left(\frac{0.2\ mg}{cm^{2}}\right) \times ABS_{d} \times \left(\frac{10^{-6}\ Kg}{1\ mg}\right)}$$

- Total.

$$SL_{w\text{-}sol\text{-}ca\text{-}tot}\ (mg/kg) = \frac{1}{\frac{1}{SL_{w\text{-}sol\text{-}ca\text{-}ing}} + \frac{1}{SL_{w\text{-}sol\text{-}ca\text{-}der}} + \frac{1}{SL_{w\text{-}sol\text{-}ca\text{-}inh}}}$$

Figure 2- Calculation of Soil Volatilization Factors (VFs)

$$VF = \frac{\frac{Q}{C_w} \times (3.14 \times D_A \times T)^{\frac{1}{2}} \times 10^{-4} \left(m^2 / cm^2 \right)}{2 \times \rho_b \times D_A}$$

where

$$\frac{Q}{C_w} = A \times \exp\left[\frac{(\ln A_s - B)^2}{C} \right] \text{ and}$$

$$D_A = \frac{\left[\left(\theta_a^{10/3} \times D_{ia} \times H' + \theta_w^{10/3} \times D_{iw} \right) / n^2 \right]}{\rho_b \times K_d + \theta_w + \theta_a \times H'}$$

Where:

Variable	Definition	Long-Term Worker	Construction Worker
Q/C_w	Site-specific dispersion factor which is the inverse of the ratio of the geometric mean air concentration to the emission flux at the center of the source or at the boundary of the source (g/m^2-sec per kg/m^3)	35.7	6.80
A	Constants based on air dispersion modeling for specific climate zones (dimensionless)	12.5	2.454
B		18.45	17.57
C		210.5	189
A_s	Area of extent of site soil contamination (acres)	40	
K_d	Soil water partition coefficient (cm^3/g)	Chemical specific; calculated as $K_d = K_{oc} \times f_{oc}$; K_{oc} for 1,2-dichloroethane and ethylbenzene presented in Table 2; foc is assumed to be 0.006 (USEPA, 2009)	
DA	Apparent diffusivity (cm^2/s)	Chemical-specific; Refer to Table 2	
$ø_a$	Air filled porosity (L_{air}/L_{soil})	0.284 (USEPA, 2009)	
Di_a	Diffusivity in air (cm^2/sec)	Chemical-specific; Refer to Table 2	
H'	Henry's Law Constant (dimensionless)	Chemical-specific; Refer to Table 2	
$ø_w$	Water filled soil porosity (Lwater/Lsoil)	0.15 (USEPA, 2009)	
D_{iw}	Diffusivity in water (cm2/sec)	Chemical-specific; Refer to Table 2	
n	Total soil porosity (Lpore/Lsoil) (1-(ρ_d/ρ_s)	0.434 (USEPA, 2009)	
ρs	Soil particle density (g/cm^3)	2.65 (USEPA, 2009)	
ρ_b	Dry soil bulk density (g/cm^3)	1.5 (USEPA, 2009)	
K_d	Soil water partition coefficient (cm^3/g)	Chemical-specific; Refer to Table 2	
D_A	Apparent diffusivity (cm^2/s)	Chemical-specific; Refer to Table 3	
$ø_a$	Air filled porosity (Lair/Lsoil)	0.284	
D_{ia}	Diffusivity in air (cm^2/sec)	Chemical-specific; Refer to Table 3	
H'	Henry's Law Constant (dimensionless)	Chemical-specific; Refer to Table 3	
$ø_w$	Water filled soil porosity (L_{water}/L_{soil})	0.15	

Variable	Definition	Long-Term Worker	Construction Worker
D_{iw}	Diffusivity in water (cm2/sec)	Chemical-specific; Refer to Table 3	
n	Total soil porosity (Lpore/Lsoil) (1-(ρd/ρs)	0.434	
ρ_s	Soil particle density (g/cm3)	2.65	
ρ_d	Dry soil bulk density (g/cm3)	1.5	
T	Exposure interval (seconds) [equal to the exposure duration expressed in second]	9.50E+08	3.154E+07

Table 1- Equation Inputs

Parameter	Description	On-site Worker (long term worker)	Construction Worker	Reference
ABSd	Dermal absorption fraction (unitless)	Contaminant-specific; see Table 2	Contaminant-specific; see Table 2	USEPA, 2004
AFow	Soil adherence to skin (mg/cm^2)	0.2	0.3	USEPA, 2002
ATow	Averaging time (days/exposure period)	25,550 days (cancer risk); 9125 days (noncancer risk)	25,550 days (cancer risk); 365 days (noncancer risk)	USEPA, 2002
BWow	Body weight (kg)	70	70	USEPA, 2002
CSFo	Oral slope factor (kg-day/mg)	Contaminant-specific; see Table 2	Contaminant-specific; see Table 2	IRIS, 2009; USEPA, 2009
EDow	Exposure Duration (yr)	25	1	USEPA, 2002
EFiw	Exposure Frequency (days/yr)	250	250	USEPA, 2002
ETws	Exposure Time-air (hr/hr)	0.33	0.33	8 hours per 24 hour day
GIABS	Fraction of contaminant absorbed in gastrointestinal tract (unitless)	1 (for all contaminants)	1 (for all contaminants)	U.S. EPA 2004
IRow	Soil ingestion rate (mg/day)	100	330	USEPA, 2002
IUR	Inhalation unit cancer risk (m^3/ug)	Contaminant-specific; see Table 2	Contaminant-specific; see Table 2	IRIS, 2009; USEPA, 2009
PEFw	Soil particle emission factor (m^3/kg)	1.40E+09	1.00E+06	USEPA, 2009; CalEPA, 2005
RfC	Reference concentration (mg/m^3)	Contaminant-specific; see Table 2	Contaminant-specific; see Table 2	IRIS, 2009; USEPA, 2009
RfDo	Oral reference dose (mg/kg/day)	Contaminant-specific; see Table 2	Contaminant-specific; see Table 2	IRIS, 2009; USEPA, 2009
SAow	Skin surface area exposed to soil (cm^2)	3300	3300	U.S. EPA 2002
THQ	Target Hazard Quotient	1	1	--
TR	Target Cancer Risk	1.00E-05	1.00E-05	--
VFs	Soil volatilization factor (m^3/kg)	Contaminant-specific; see Table 2	Contaminant-specific; see Table 2	

Table 2
Chemical-Specific Inputs Used to Calculate Risk-Based Concentrations for Soil

Chemical	Chronic RfC (mg/m^3)	Chronic RfD (mg/kg/day)	Subchronic RfC (mg/m^3)	Subchronic RfD (mg/kg/day)	IUR (m^3/ug)	SF$_o$ (mg/kg/day)$^{-1}$	ABS unitless	Considered volatile by USEPA?	D$_A$ (cm^2/s)	D$_{ia}$ (cm^2/s)	D$_{iw}$ (cm^2/s)	H' dimension-less	K$_{oc}$ (cm^3/g)	K$_d$ (cm^3/g)	VFs m^3/kg
Aldrin	not avail	3.0E-05	not avail	not avail	4.9E-03	1.7E+01	0.1	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
Chlordane	7.0E-04	5.0E-04	not avail	not avail	1.0E-04	3.5E-01	0.04	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
1,2-Dichloroethane	2.4E+00	2.0E-02	not avail	not avail	2.6E-05	9.1E-02	not appl	YES	5.94E-04	0.086	1.10E-05	4.80E-02	4.38E+01	2.63E-01	2630 (long-term worke 92.5 (const. worker)
Dieldrin	not avail	5.0E-05	not avail	1.00E-04	4.6E-03	1.6E+01	0.1	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
Dinoseb	not avail	1.0E-03	not avail	not avail	not avail	not avail	0.1	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
Hexachlorocyclohexane-gamma (gamma-BHC)	not avail	not avail	not avail	not avail	5.3E-04	1.8E+00	0.1	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
Hexachlorocyclohexane-gamma (gamma-BHC)	not avail	5.0E-03	not avail	not avail	3.1E-04	1.1E+00	0.04	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
Propanil	not avail	2.0E-02	not avail	not avail	not avail	not avail	0.1	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl
Toxaphene	not avail	not avail	not avail	1.00E-03	3.2E-04	1.1E+00	0.1	no	not appl	not appl	not appl	not appl	not appl	not appl	not appl

not avail- USEPA toxicity value not available
not appl- not applicable; chemical not volatile
RfC = Reference concentration
RfD = Reference dose
IUR = Inhalation Unit Risk
SFo = Oral slope factor
ABS = Dermal absorption factor
D_A = Apparent diffusivity
D_{ia} = Diffusivity in air
D_{iw} = Diffusitity in water
H' = Henry's Law Constant
K_{oc} = Soil organic carbon partition coefficient
K_d = Soil water partition coefficient

APPENDIX B

Breakdown of Estimated Costs for Specific Remedy Elements

REMEDIAL DESIGN AND WORKPLANS					Total:	$383,660
1. Field and Design Labor						$328,310
Assume	80	Principal	$205	per hour		$16,400
Assume	400	Senior I	$160	per hour		$64,000
Assume	650	Project II	$156	per hour		$101,400
Assume	850	Staff II	$99	per hour		$84,150
Assume	600	CAD	$76	per hour		$45,600
Assume	80	Clerical Support	$72	per hour		$5,760
Assume	10	Copying/Reproduction	$1,000	per copy		$10,000
Assume	10	Shipping	$100	per copy		$1,000
2. SVE System Pilot Testing						$15,020
Assume	1	Test Extraction Wells	$2,500	each		$2,500
Assume	4	DPT Observation Points	$1,100	each		$4,400
Assume	1	Rental SVE Unit Skid, delivered	$3,000	each		$3,000
Assume	6	TO-14, Major Gas Analyses	$450	each		$2,700
Assume	6	Subsistence/per diem	$150	each		$900
Assume	2	Airfare	$460	each		$920
Assume	5	Vehicle	$100	each		$500
Assume	5	Vehicle fuel	$20	each		$100
3. Sampling Pond Sludge and Former Dinoseb Disposal Pond Soils						$19,830
Assume	2	DPT Rig & Crew	$3,000	per day		$6,000
Assume	1	Jon Boat and Motor	$4,000	each		$4,000
Assume	1	Sludge Sampling Tool	$750	each		$750
Assume	1	Other Sampling/Thickness/Field Equipment	$2,000	each		$2,000
Assume	30	Subsistence/per diem	$150	each		$4,500
Assume	3	Airfare	$460	each		$1,380
Assume	10	Vehicle	$100	each		$1,000
Assume	10	Vehicle fuel	$20	each		$200
4. Bench Scale Testing of Stabilant for Sludge and Soils						$20,500
Assume	8	Tests of soil/sludge stabilants	$1,500	each		$12,000
Assume	10	Geotechnical and Waste Characterization Analyses	$850	each		$8,500

Note: AMEC Labor and Expense Pricing from 2009 Cedar Chemical Pricing Schedule
Costs assume power available for SVE skid.

DRUM VAULT				TOTAL:	$742,995.55
1. Mobilization/Demobilization & Rental Equipment					$153,968.00
Assume	1	Mobilization/Demobilization (crew)	$1,950.00	each	$1,950.00
Assume	2	Track Hoe Delivery/Pickup	$1,200.00	each	$2,400.00
Assume	1	Track Hoe With Thumb Rental (picking up demo material)	$5,520.00	per month	$5,520.00
Assume	1	Track Hoe Rental (Tearing down)	$5,718.00	per week	$5,718.00
Assume	60	Roll Off Box Delivery/Pickup	$720.00	each	$43,200.00
Assume	120	Roll Off Box Rental	$20.00	each	$2,400.00
Assume	120	Roll Off Box Liners	$40.00	each	$4,800.00
Assume	2	Frac Tank Delivery	$720.00	each	$1,440.00
Assume	30	Frac Tank Rental	$75.00	each	$2,250.00
Assume	1	Hydraulic Breaker Rental	$5,720.00	per month	$5,720.00
Assume	1	Roll Off Frame (Onsite to Spot Boxes)	$7,800.00	each	$7,800.00
Assume	1	Third Party Air Monitoring	$45,000.00	each	$45,000.00
Assume	2	Dozer (D-3 or Equivalent) Delivery/Pickup	$1,200.00	each	$2,400.00
Assume	1	Dozer (D-3 or Equivalent)	$1,590.00	per week	$1,590.00
Assume	165	Backfill Delivered	$132.00	per load	$21,780.00
2. Warehouse Demolition - Level D					$19,010.00
Assume	3	Warehouse Demolition	$4,675.00	per day	$14,025.00
Assume	3	Transportation to Local Recycler	$995.00	per day	$2,985.00
Assume	20	Warehouse demo to landfill as Class 2 Waste	$25.00	tons	$2,000.00
3. Concrete Removal - Level B					$23,550.00
Assume	3	Concrete Demo/Loading in Roll Off Boxes	$7,850.00	per day	$23,550.00
4. Vacuum Liquid from Vault - Level B (Confined Space)					$36,725.00
Assume	3	Vacuum Liquid From Vault	$10,250.00	per day	$30,750.00
Assume	1	Frac Tank Cleaning	$5,975.00	per day	$5,975.00
5. Solidify Sludge/Slurry in Vault - Level B (Confined Space)					$47,094.55
Assume	5	Solidify Sludge & Load In Roll Off Boxes	$9,300.00	per day	$46,500.00
Assume	2	Solidification Agent (Bentonite)	$297.27	per ton	$594.55
6. Sludge Removal From Vault in Roll Off Boxes - Level B					$46,500.00
Assume	5	Sludge Removal From Vault	$9,300.00	per day	$46,500.00
7. Back Fill of Vault with Soil					$13,278.00
Assume	3	Backfill Vault	$4,426.00	per day	$13,278.00
8. Disposal					$187,420.00
Assume	3500	Disposal of Solid Waste Non-Hazardous	$25.20	per ton	$88,200.00
Assume	120	Trans of Solid Non-Hazardous Waste	$270.00	per trip	$32,400.00
Assume	110	Disposal of Liquid Waste Non-Hazardous	$102.00	per ton	$11,220.00
Assume	8	Trans of Liquid Non-Hazardous Waste	$1,350.00	per trip	$10,800.00
Assume	128	Certified Truck Washout	$350.00	each	$44,800.00
9. Subcontractor Project Oversight					$22,100.00
Assume	1	Office Trailer	$500.00	per month	$500.00
Assume	150	Per Diem/Lodging each man	$125.00	per day	$18,750.00
Assume	30	days vehicle rental	$65	per day	$1,950
Assume	30	days vehicle fuel	$30	per day	$900
Assume	1500	Technician	$65	per day	$97,500
10. AMEC Project Oversight					$193,350.00
Assume	150	days Per Diem/Lodging at	$130.00	per day	$19,500.00
Assume	1500	hours Senior Technician at	$86.00	per hour	$129,000.00
Assume	150	hours Project Management	$160.00	per hous	$24,000.00
Assume	5	airfares at	$470.00	per trip	$2,350.00
Assume	155	days vehicle rental at	$100	per day	$15,500
Assume	100	days vehicle fuel at	$30	per day	$3,000

Note: Subcontractor cost from USES 2008 Pricing
AMEC Labor and Expenses Pricing from Cedar Chemical 2009 Pricing Schedule

SOIL VAPOR EXTRACTION SYSTEM INSTALLATION/CONSTRUCTION				Total:	$199,924
1. Power to Site					$10,000
Assume	$10,000	to drop electrical connection to system, including: • Installation by a qualified electrician; • Installation of main disconnect; • Installation of an electrical meter face.			
2. SVE System Equipment					$81,000
Assume	1	Regenerative Blower			$18,000.00
Assume	1	Knockout Pot and Transfer Pump			$10,000.00
Assume	1	Storage Tank			$5,000.00
Assume	1	Pipe rack to connect vessels			$5,000.00
Assume	1	Control Panel			$5,000.00
Assume	1	Instrumentation & Update System			$10,000.00
Assume	2	Granular Activated Carbon Vessels			$28,000.00
3. SVE System Installation					$91,200
Assume	20	SVE wells at	$2,500.00	per well	$50,000.00
Assume	350	feet of trenching at	$30.00	per linear foot	$10,500.00
Assume	350	feet of piping at	$30.00	per linear foot	$10,500.00
Assume	350	feet of resurfacing at	$12.00	per linear foot	$4,200.00
Assume	8	wellhead fittings at	$400.00	per well	$3,200.00
Assume	25	sqft concrete pad at	$11.00	per sqft	
Assume fencing cost to enclose system of			$1,700		$1,700.00
Assume	1	piping costs		total	$10,000.00
Assume	4	TO-14 Analysis at Start-up	$275	per sample	$1,100.00
4. Installation Direction and Oversight					$17,724
Assume	1	Project Scientist I	$113	per hour	
Assume	8	hours of travel to/from the site			$904
Assume	120	hours of system inspection and maintenance			$13,560
Assume	10	night hotel stay at	$100	per day	$1,000
Assume	10	days per diem at	$30	per day	$300
Assume	10	days vehicle rental at	$100	per day	$1,000
Assume	8	days vehicle fuel at	$30	per day	$240
Assume airfare and parking costs of			$470	round trip.	$470
Assume field supplies cost of			$250		$250

Note: Pricing from TECHSAS

AMEC Labor and Expense Pricing from Cedar Chemical 2009 Pricing Schedule.

SOIL COVER				Total:	$2,221,360.00
1. GeoTextile Equipment and Materials					$325,000.00
Assume	20	days to complete			
Assume	460 Loads	clean fill	$8,280.00	per load	$207,000.00
Assume	5	geotextile	$20,000.00	per acre	$100,000.00
Assume	20	Equipment	$400.00	per day	$8,000.00
Assume	1	Geotechnical Testing	$10,000.00	ea	$10,000.00
2. Geotextile Subcontract Labor+Expenses					$15,000.00
Assume	1	subcontractor labor + per diem (2 techs *20 day)	$ 15,000.00		$15,000.00
3. Paving					$1,710,000.00
Assume	380,000	sqft at	$4.50	per sqft	$1,710,000.00
4. AMEC Project Oversight					$171,360.00
Assume	3	months Office Trailer	$500.00	per month	$1,500.00
Assume	120	days Per Diem/Lodging	$130.00	per day	$15,600.00
Assume	1440	hours Senior Technician	$86.00	per hour	$123,840.00
Assume	80	hours Project Manager	$160.00	per hour	$12,800.00
Assume	6	airfares	$470.00	per trip	$2,820.00
Assume	130	days vehicle rental	$100	per day	$13,000
Assume	60	days vehicle fuel	$30	per day	$1,800

Note: Paving Pricing from Alamo 1, Geotextile pricing from USES
* Footage assumes a 20% coverage by existing concrete pads
AMEC Labor and Expense pricing from Cedar Chemical 2009 Pricing Schedule.

DEMOLITION COSTS WITH SALVAGE COSTS				Total:	$3,692,430.00
1. Demolition					$3,337,500.00
Assume	67,500	sqft at	$5.00	per sqft	$337,500.00
Assume a flat rate to demo process equipment and piping of					$4,000,000.00
Assume	25%	salvage value for scrap equipment /piping			$1,000,000.00
2. AMEC Project Oversight					$354,930.00
Assume	9	months Office Trailer at	$500.00	per month	$4,500.00
Assume	270	days Per Diem/Lodging at	$130.00	per day	$35,100.00
Assume	3240	hours Senior Technician at	$86.00	per hour	$278,640.00
Assume	12	airfares	$470.00	per trip	$5,640.00
Assume	270	days vehicle rental at	$100	per day	$27,000
Assume	135	days vehicle fuel at	$30	per day	$4,050

Note: Demolition pricing from Alamo 1
AMEC Labor and Expense Pricing from Cedar Chemical 2009 Pricing Schedule

FORMER DINOSEB DISPOSAL POND AREA STABILIZATION COSTS				Total:	$612,261
1. Mobilization					$16,700.00
Assume	2	D6 Dozer delivery/pickup at	$1,200.00	each	$2,400.00
Assume	4	60' Trackhoe delivery/pickup at	$1,200.00	each	$4,800.00
Assume	1	Water Truck delivery/pickup at	$800.00	each	$800.00
Assume	4	210 Trackhoe delivery/pickup at	$1,200.00	each	$4,800.00
Assume	1	Office Trailer delivery/pickup at	$2,500.00	each	$2,500.00
Assume	4	6" pumps delivery/pickup at	$350.00	each	$1,400.00
2. Clearing and Grubbing					$2,070.00
Assume	0.46	acres (20,000 sqft) at	$4,500.00	per acre	$2,070.00
3. Mixing (50 cubic yards per hour)					$554,170.50
Assume	3600	tons of portland cement	$126.00	per ton	$453,600.00
Assume	445	hours Long Stick Trackhoes at	$179.10	per hour	$79,699.50
Assume	56	hours Supervisor at	$60.00	per hour	$3,360.00
Assume	112	hours Laborers at	$28.00	per hour	$3,136.00
Assume	25	Mats at	$575.00	each	$14,375.00
7. AMEC Oversight					$39,320
Assume	1	month Office Trailer at	$500.00	per month	$500
Assume	30	days Per Diem at	$100.00	per day	$3,000
Assume	360	hours Senior Technician at	$86.00	per hour	$30,960.00
Assume	3	airfares	$470.00	per trip	$1,410.00
Assume	30	days vehicle rental at	$100	per day	$3,000
Assume	15	days vehicle fuel at	$30	per day	$450

Note: Pricing based on costs provided by Russell Duke of USA Environment.
AMEC Labor and Expense Pricing based on Cedar Chemical 2009 Pricing Schedule.

SOIL VAPOR EXTRACTION OPERATION & MAINTENANCE (PER ANNUM)					Total:	$54,475
1. Utilities/Carbon						$20,532
Assume	10	HP pump (240 scfm @ 50" of vacuum)				
Assume	8760	System run-time (hours/year)				
Assume	$0.10	per kilowatt hour		Electrical Total:		$6,532
Assume	4	Carbon Changes at	$3,500	per change:		$14,000
2. Analytical Costs						$1,745
Assume	1	VOC in water analysis	$125	per sample		$125
Assume	1	SVOC in water analysis	$250	per sample		$250
Assume	1	RCRA metals in water analysis	$100	per sample		$100
Assume	1	TPH in water analysis	$60	per sample		$60
Assume	1	RCI in water analysis	$110	per sample		$110
Assume	4	TO-14 analysis	$275	per sample		$1,100
3. System Operation						$26,088
Assume	1	technician at	$86	per hour		
Assume	6	hours of travel to/from the site from Houston, TX				$516
Assume	8	hours of system inspection, sampling, and maintenance				$688
Assume	1	night hotel stay at	$150	per day		$150
Assume	2	days per diem at	$30	per day		$60
Assume	2	days vehicle rental at	$65	per day		$130
Assume	2	days vehicle fuel at	$30	per day		$60
Assume airfare and parking costs of			$470	round trip.		$470
Assume field supplies cost of			$100	per inspection		$100
Assume	12	events at	$2,174	per event		$26,088
4. Fluid Disposal						$6,110
Assume	2000	gallons of hazardous water disposal	$2.50	per gallon		$5,000
Assume	8	hours of vacuum truck (includes transport)	$95	per hour		$760
Assume	1	Truck washout	$350	each		$350

Note: Carbon pricing from Seimens (formerly US Filter)
Analytical costs from ALS Laboratories.
Water analytical for annual waste profiling

MONITORED NATURAL ATTENUATION (MNA) PER ANNUM				**Total:**	**$101,380.00**
1. Groundwater Monitoring Well Sample Analysis					$52,000.00
Assume	89	samples (75 well samples, 7 field blanks & 7 duplicates)			
Assume	82	analyzed for VOCs at	$100.00	per sample	$8,200.00
Assume	89	analyzed for SVOCs/Pest/Herb at	$200.00	per sample	$17,800.00
Assume	2	sampling events per year at	$26,000.00	per event	$52,000.00
2. Labor (for sampling)					$39,380.00
Assume	12	hours per technician/day for	10	days per event	
Assume	2	hours sample shipping at	1	per event	
Assume	24	hours mob for 2 technicians at	1	per event	
Assume	226	hours for 2 technicians at	$65.00	per hour	$14,690.00
Assume per diem/ travel/lodging expenses cost of			$5,000.00	per event	
Assume	2	sampling events per year at	$19,690.00	per event	$39,380.00
Assume	1	Annual Report for both events	$35,000.00	per report	$35,000.00
3. Rental of Equipment					$10,000.00
Assume	10	days rental equipment at	$500.00	per day	$5,000.00
Assume	2	sampling events per year at	$5,000.00	per event	$10,000.00

Note: Field blanks analyzed for VOCs only
Assumes all wells will be sampled for VOCs, SVOCs, pesticides and herbicides.
AMEC Labor and Expense Pricing from Cedar Chemical 2009 Pricing Schedule
Analytical Pricing from TestAmerica Laboratory, Austin Texas.

ADDITIONAL GROUNDWATER MONITORING WELLS			**$53,450.00**
1. Groundwater Monitoring Well Sample Analysis			$53,000.00
Assume	6	CMT monitoring wells	$45,000.00
Assume	6	Development	$3,000.00
Assume		IDW Water IDW Management	$5,000.00
2. Labor (for subcontractor and AMEC oversight)			$35,000.00
Assume	20	days per diem for subcontractor	$10,000.00
Assume	20	days per diem plus labor and expenses for AMEC field geologist	$25,000.00
Assume	2	Airfare	$900.00
Assume	25	days per diem (including PM and Field 130.00/day)	$3,250.00
Assume	25	days vehicle rental at 100/day	$2,500.00
Assume	15	days vehicle fuel at 30/day	$450.00

Note: Monitoring well installation pricing from Boart Longyear.
Assumes costs for monitoring wells on property southwest of Industrial Park Only
AMEC Labor and Expenses from 2009 Cedar Chemical pricing schedule

DECOMMISSIONING				Total:	$210,343.60
1. Monitoring and Recovery Well Plugging					$144,950.00
Assume	1	Mob/Demob	$600.00	ea	$600.00
Assume	30	Total days of per diem (3 man crew)	$120.00	man/day	$3,600.00
Assume	15	CMT Wells Plugged and abandoned at 19/ft Assume wells are 145ft deep each	$2,755.00	each	$41,325.00
Assume	15	CMT Wells Backfilled and abandon at 9/ft/145ft	$1,305.00	each	$19,575.00
Assume	30	Overdrill 2-inch conventional well depth 35 feet 19/ft	$665.00	each	$19,950.00
Assume	30	Overdrill 2-inch conventional well depth 110 feet 19/ft	$1,050.00	Each	$31,500.00
Assume	60	Backfill and abandon at 9/ft/35ft	$315.00	each	$18,900.00
Assume	15	Staging materials	$250.00	hours	$3,750.00
Assume	75	State well reports	$10.00	each	$750.00
Assume	1	IDW Management Class 2 Waste	$5,000.00	All	$5,000.00
2. SVE System Decommissioning					$12,183.60
Assume	1	Mob/Demob	$1,000.00	each	$1,000.00
Assume	4	Equipment Rental	$350.00	days	$1,400.00
Assume	5	Labor (4 man crew, 10 hrs/day)	$1,800.00	days	$9,000.00
Assume	5	Total days of per diem (4 man crew)	$120.00	man/day	$600.00
Assume	4	Class I disposal	$45.90	ton	$183.60
Assume	20	Wells plugged and abandoned (est. depth 20 ft/28/ft)	$560.00	each	$11,200.00
3. AMEC Oversight					$53,210.00
Assume	35	days Per Diem/Lodging at	$130.00	per day	$4,550.00
Assume	540	hours Senior Technician at	$86.00	per hour	$46,440.00
Assume	2	airfare	$470.00	per trip	$940.00
Assume	16	days vehicle rental at	$65	per day	$1,040
Assume	8	days vehicle fuel at	$30	per day	$240

Note: P&A Costs from Best Drilling and Boart Longyear
AMEC Labor and Expense Pricing from Cedar Chemical 2009 Pricing Schedule

FUTURE POND CLOSURES (Stabilization)				Total:	$963,980.21
1. ASTs, API Separator, and Clarifiers Decommissioning					$30,000.00
2. Mobilization					$16,700.00
Assume	2	D6 Dozer delivery/pickup at	$1,200.00	each	$2,400.00
Assume	4	60' Trackhoe delivery/pickup at	$1,200.00	each	$4,800.00
Assume	1	Water Truck delivery/pickup at	$800.00	each	$800.00
Assume	4	210 Trackhoe delivery/pickup at	$1,200.00	each	$4,800.00
Assume	1	Office Trailer delivery/pickup at	$2,500.00	each	$2,500.00
Assume	4	6" pumps delivery/pickup at	$350.00	each	$1,400.00
3. Dewatering Ponds					$45,000.00
Assume	30	Pumps and crew	$1,500.00	per day	$45,000.00
4. Stabilizing Pond Sludge					$600,075.93
Assume	4,000	tons of portland cement	$126.00	per ton	$504,000.00
Assume	350	hours Long Stick Trackhoes at	$179.10	per hour	$62,685.93
Assume	40	hours Supervisor at	$60.00	per hour	$2,400.00
Assume	80	hours Laborers at	$28.00	per hour	$2,240.00
Assume	50	Mats at	$575.00	each	$28,750.00
5. Pond Area Grading					$60,728.00
Assume	400	hours Dozers at	$148.82	per hour	$59,528.00
Assume	20	hours Supervisor at	$60.00	per hour	$1,200.00
6. Topsoil Placement					$169,931.34
Assume	8,861	truck yards of top soil	$17.50	per truck yd	$155,067.50
Assume	90	hours D6 Dozer at	$149.82	per hour	$13,483.84
Assume	23	hours Supervisor	$60.00	per hour	$1,380.00
7. Revegetation					$41,544.95
Assume	198,809	sqft Hydromulch at	$0.11	per sqft	$20,874.95
Assume	1	irrigation water	$10,000.00	each	$10,000.00
Assume	1	irrgation system	$5,000.00	each	$5,000.00
Assume	300	hours Labor at	$18.90	per hour	$5,670.00
8. AMEC Project Oversight					$79,240.00
Assume	2	months Office Trailer at	$500.00	per month	$1,000.00
Assume	60	days Per Diem/Lodging at	$130.00	per day	$7,800.00
Assume	720	hours Senior Technician at	$86.00	per hour	$61,920.00
Assume	6	airfares	$470.00	per trip	$2,820.00
Assume	60	days vehicle rental at	$65	per day	$3,900
Assume	60	days vehicle fuel at	$30	per day	$1,800

Note: Demolition pricing from Alamo 1
AMEC Labor and Expense Pricing from Cedar Chemical 2009 Pricing Sheet
Volume and character of sludge to be stabilized is not known, these costs assume 5' of sludge typical thickness, approximately 20,000 cy sludge total.
Assumes pond areas re-graded using existing materials, with no import of backfill.
Assumes revegetation established in 3 months, all mowing and other maintenance by site owner/operator.